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THE ELECTRIC RAILWAY SYSTEM OF THE FUTURE.

What will be the final outcome of the energy now being expended in developing electric railway systems? Every practical type of motor has its advocates, and nearly all of these types have been tried on a more or less extensive scale. The series motor—the stand-by for so many years—has many rivals, but it still has the confidence of its old friends, and is almost invariably applied where the conditions are not unusual. The mere fact that a new system is larger than the one which preceded it can not be considered unusual: it is merely an evidence of healthy growth. The latest great undertaking in this field is the starting of the first branch of the electrical section of the Long Island Railroad. Here the direct-current system has been adopted, with the improved methods of control developed during the last few years. The direct-current motor is such a satisfactory machine, and is so thoroughly understood, that one wonders whether a further modification of its equipment would not give it a new lease of life. When the Cooper Hewitt mercury vapor rectifier was first described, its application to railway work was at once suggested. Since then rectifiers of this type have been well developed, and may now be made with fairly large output for use on single-phase circuits. Why would not such an addition to a direct-current equipment adapt it to operating on single-phase circuits? All that is needed is a rectifier suitable for placing on an electric car. As soon as this is available—and we see no reason why it should not come before long—every electric railway system will have its field of profitable development widely extended, without it being necessary to scrap a large amount of costly apparatus.

THE EFFICIENCY OF ELECTROSTATIC MACHINES.

The electrostatic generator—the oldest of our mechanical generators of electricity—has been sadly neglected. These machines seem to be designed by rule-of-thumb methods, each maker following the paths taken by those who preceded him, and venturing to make but slight changes. Until recently little or nothing was known of their performance, although it was realized that their output per pound was small, and it was thought that their efficiency was low.

The work conducted by Dr. Samuel Sheldon for the American Electrotherapeutic Association sheds considerable light upon the performance of these machines, and gives them a better character than they before enjoyed. Dr. Sheldon has determined the efficiencies of several electrostatic machines of different makes and he finds that they run as high as forty per cent—a very creditable figure indeed considering the small output which they give. Of three machines tested the average efficiency was over forty-two per cent with an output of only thirteen watts. We doubt whether any other electrical machines of such small output can show a record as good as this.

The method of determining these efficiencies is interesting. Two machines were coupled together, and one was driven as a dynamo, the other running as a motor. The power delivered to the first—which in this case was supplied by a small electric motor—was measured, and a light Prony brake applied to the second machine, which was running as a motor. In this way the efficiency of the system was determined. By means of three machines three groupings were possible and the various efficiencies were separated, with the result mentioned above.

The losses in these machines are due to several causes: to mechanical friction and wind friction, which are undoubtedly the largest; leakage of current and possible dielectric losses. This suggests that the machine might be improved as regards output. The present accepted type is bulky, and the speed comparatively low. It might be possible by proper construction to increase the latter considerably and probably a different arrangement of inducing surfaces might be found which would also increase the output. In general there are but two collecting points on such machines, although we got beyond the two-pole machines in dynamo-electric machines years ago.

ELECTRICITY IN THE COAST DEFENSE.

Fortunately most of us are more familiar with the applications of electricity in the arts of peace than in the art of war. Many of us have seen its introduction revolutionize entire industries and witnessed the birth and the growth to magnificent proportions of entirely new ones. We have seen it not only take the place of systems familiar to our fathers, but have seen it come out victorious in many a hotly contested fight with new rivals. We can think of no other factor which has touched the lives of so many people.

When one calls to mind the important part which the electrical arts are taking in our every-day lives, is it not logical to assume that the part which they will play—in fact, the part which they are now playing—in times of war will be as vital? Happily, we are under no necessity just now for putting electricity to use in war, but our duty does not end here. While always desiring peace, we should nevertheless recognize the possibility of war. We must always be ready to resist force with force, and we must not be caught unprepared. While some question may be raised as to the amount of preparation necessary, no one will question the advisability of having what we do use of the latest and best; and the introduction of electrical methods into military and naval services is bringing about such changes, and so greatly increasing the efficiency of apparatus that it behooves us to keep up with these advances. If we are negligent in this matter we may realize it to our sorrow when it is too late.

We have seen how all-important electrical methods of communication are to an army on the offensive, from the recent campaign in Manchuria. We have also heard—however, rather indefinitely—of the important part played in the recent naval battle by the Japanese wireless telegraph apparatus. At the battle of Mukden it was the telephone and the telegraph which really won the fight, as was described recently in the ELECTRICAL REVIEW, and now it is reliably reported that the part played by the Japanese wireless telegraph system in the recent naval battle was just as important. It is said that Admiral Togo had many small scouting vessels equipped with wireless apparatus, which were watching the Russian fleet constantly and communicating with shore stations, the latter forwarding the information to the admiral. At no time after the Russian fleet approached Japan was he ignorant of its position. Forewarned is indeed forearmed, and to him who hath communications shall the victory be.

But it is another use of electricity in the art of war to which we wish to call attention—the coast defense service. It is being used here for many purposes: for traversing and lifting guns, where it greatly increases the efficiency of the weapons; for controlling the fire of the guns from the commander's station; for harbor defense by means of mines of various descriptions; for signaling of all kinds; for searchlights—in fact, there is hardly a branch of the service in which it is not being applied for some purpose or other.

Naturally, as its use becomes so extensive, there must be thoroughly competent electrical experts in the artillery corps, to whom falls the responsibility for equipping and maintaining our coast defenses. This necessity is well recognized by the officers of the artillery corps, who are doing what they can to meet it. A fairly well-equipped electrical school has been established at Fort Totten, N. Y., where a certain number of officers and non-commissioned officers are assigned every year for electrical training. The work of this school is described on another page of this issue. It will be seen that while the course is a thorough one, well adapted to its purpose, the accommodations are much too small. At the present time there is room for but ten students in the officers' school, and but twenty-eight men in the electrician-sergeants department. To operate the power plants and the electrical apparatus in our coast defenses requires about 200 officers and 5,000 men. Obviously, the present rate at which they are being turned out is inadequate. There is urgent need for an enlargement of this school and for additional apparatus. The power plants required at some of the principal fortresses are fairly large. The machinery is expensive, and the men put in charge should be thoroughly trained for this service. Handling a ten-horse-power generating set does not make a man competent to take care of an important station. The school at Fort Totten should be provided with a satisfactory power plant of adequate size. This would be doubly useful here, for it would not only provide training for the men, but would supply the needs of the fort. Money expended for this purpose would probably produce greater results than a similar expenditure in almost any other way. It is not a question of greatly increasing our coast defenses, but of providing men who will be competent to make those we have most efficient. The sum of money needed for this purpose is small, when compared with other demands on the government, yet the improvement in the service which it would make possible is not easily overestimated.

Of the many subsidiary devices which necessity has produced as essential for the satisfactory operation of electrical plants, there does not appear to be anything further from the ordinary than the fog boxes on high-potential transmission lines near to the Pacific coast.

These lines have been impaired by fogs which deposited sufficient mixture on the poles and insulators to provide escapes which frequently burned cross-arms or even poles; in some instances the adhesion of dust produced similar results.

These difficulties have been obviated by sheltering the insulators by V-shaped boxes made of redwood boards placed over each insulator, protecting both the insulator and its pin by a little shed nine inches long and six inches wide.

The startling physiological effects of electricity upon the human system fully warrant the use of the word as a superlative term to express enthusiastic conditions.

This expression must have come into use at an early day, soon after Franklin made the static electrical machine a matter of general knowledge, for Thomas Jefferson in his autobiography stated: "Paine's 'Common Sense' electrified us."

Thomas Paine's book was issued January 1, 1776, and as Jefferson's autobiography was founded on his diary, it is probable that the sentence was written by Jefferson at the same time.

MAGNETIC ALLOYS CONTAINING NO IRON.

For some time past the scientific world has been much interested in the magnetic properties of alloys. It has been shown that the presence of certain other metals in iron may improve its magnetic qualities, and at one time it was even suggested that we might be able, by a proper mixture, to obtain an alloy having good magnetic qualities and poor electrical qualities. Such an alloy would enable us to cast certain parts of our electrical machinery which to-day we are accustomed to build up of laminations, but as yet we are far from this happy condition.

More recently, still greater interest has been drawn to certain alloys which possess magnetic qualities in a marked degree, although they contain no iron. In 1894, at a meeting of the British Association for the Advancement of Science, Mr. R. A. Hadfield exhibited a sample of a magnetic alloy which had been prepared by Dr. Heusler, and which contained copper, aluminum and manganese. At that time no quantitative results of tests of this material were published, a lack which has been supplied by a paper read recently before the Royal Society, of London, by Dr. J. A. Fleming and Mr. Hadfield, which appears on another page of this issue. Two samples of such an alloy were investigated in the usual way. Rings were cast of the material, turned to the desired form, wound with wire, and the magnetic cycles traced. One of these samples contained manganese, copper and aluminum. In addition there was a small amount of slag, consisting of oxides of manganese and silicon, a little carbon, and a trace of iron. The other contained, in addition to the metals mentioned, a little lead.

These alloys showed not only an ability to become magnetized, but they behaved as a rather poor quality of iron. The regular hysteretic cycles were obtained, proving not only that hysteresis losses take place in them, but that the material has retentivity and coercivity. The results show that magnetic saturation would occur with high magnetizing forces—in fact, the magnetic properties are identical with those of a ferromagnetic material. The maximum permeability with these samples was about twenty-eight or thirty, which is not much less than that of cobalt or a low grade of cast iron. These alloys occupy, in this respect, a position intermediate between the ferromagnetic and the paramagnetic bodies.

The most interesting conclusion reached from this research is the explanation suggested to account for magnetic properties. The most generally accepted theory of ferromagnetism is that it is a property of the chemical atom itself. This hypothesis does not fit in with the results described above, and it is suggested that magnetization is a property not of the chemical atom, but of molecular groupings. It may depend essentially on a group composed of a comparatively large number of molecules. Iron, cobalt and nickel may be magnetic simply because such groupings are easily formed; but, under proper conditions, it might be possible to bring other materials into such a condition that similar groupings will take place, the metals themselves becoming magnetic.

These discoveries are of greater scientific interest than immediate practical value. Of course, it is not impossible that we may obtain an alloy which will be more magnetic than iron itself, but it does not seem likely that any such material will replace iron in the construction of electrical machinery. Fortunately iron is our cheapest metal, and besides being magnetic it has excellent mechanical qualities. Still, it is not impossible that magnetic alloys may have other qualities which will make them desirable for special uses. Lightness is desirable for certain machines, and if we could increase the electrical resistance of the material used in electrical machinery something would be gained. The probability is that the magnetic parts of the dynamo of the future will consist mainly of iron, although other materials may be added to this. A further research into this exceedingly interesting field may be productive of methods which will be of practical value.

RUBBER CULTIVATION.

Rubber is one of our most important insulating materials. It has not only a high dielectric strength, but excellent mechanical properties for the purpose for which it is used. For some time past the supply of this almost indispensable material has not been equal to the demand, and, where possible, other materials are used in its place. Substitutes for rubber have been sought practically all over the world, but as yet none has been found. Some of the gums which have been found, and which it was thought might take the place of rubber, have been plentiful, but do not seem to come up to the requirements, while others, possibly having more satisfactory properties, can not be obtained in sufficient quantity. Cultivation seems to offer the best prospect for keeping up the supply of rubber in the future. It is true that there have been some unfortunate undertakings in cultivating rubber, but that this can be accomplished has been pretty well demonstrated, and it is to be hoped that the work will be taken up energetically and in a sound business way at once. There is the greater need for this, as it appears that the production of rubber has passed its limit and is now decreasing. According to the *India Rubber World* for July 1, the exports from Brazil of Para rubber for 1904 were only 28,792 tons, as compared with 29,319 tons for the preceding year.

During recent years there has been an effort to develop a trade in Para rubber from ports not located on the Amazon, but even here the output has declined and besides it is small. In 1904 it was only 287 tons, while in 1902 it was 357 tons. These figures, it is said, do not tell the whole story, for the quantities quoted above include the grade of rubber known as Caucho, which is not Para; and the production of this grade has been increasing during the past few years. The falling off in the production of Para rubber is therefore greater than that indicated above. Cultivation should be begun at once. Those placed in charge of the plantations should be thoroughly competent men, who not only understand the cultivation of rubber, but who are fairly familiar with the conditions obtaining in the districts where their work lies. Properly conducted such undertaking would pay handsomely. The opportunity for the right men is as great as the need of the rubber-using industries.

The Faraday Society.

The fifteenth ordinary meeting of the Faraday Society was held on Monday, July 3, 1905, at the Institution of Electrical Engineers, London, England, Mr. W. R. Cooper in the chair.

Mr. Sherard Cowper-Coles read a paper entitled "Some Notes on the Rapid Electrodeposition of Copper." The reading of the paper was illustrated by lantern-slides, and the author exhibited specimens of copper sheets, tubes, and wire made by the "centrifugal" process.

The various processes for increasing the current densities in copper deposition by using mechanical means for keeping the copper smooth are classified as follows:

(1) Revolving or moving the cathode, as in the processes of Wilde, Cotsworth, Wylie and Grant. The current density employed is comparatively low.

(2) Burnishing the copper during electrodeposition—the Elmer process. The usual current density is under twenty amperes per square foot.

(3) Insulating the growths on the copper so as to prevent further increase. For example, the Dumoulin process in which sheepskin and other impregnators are employed. The current density is thirty-five to forty amperes per square foot.

(4) Rapid circulation of the electrolyte. Examples: Thofehrn's process in which impinging jets are caused to play on the surface of a rotating cylinder (C. D. 50 to 100); Graham's process, in which the electrolyte is discharged on to a flat cathode surface (C. D. 300, just under the influence of the jets); Poore's process, in which the solution is sprayed on to the cathode, the stream forming the only electrolytic connection; Dessolle's process, used in Paris for coppering ornamental ironwork, and finally, Harrison's, likewise an impingement process. The author considers that impingement processes are not likely to be applied commercially until the amount of solution circulated can be greatly reduced.

(5) Revolving mandrel at a critical speed (centrifugal process)—This process has been developed by the author and the latest methods of working are here described. The mandrels are suspended vertically and are provided with Pelton wheels, which are driven by the electrolyte impinging against them. In the most recent form, however, a tubular vat is used, and hollow mandrels suspended on ball bearings, through the middle of which run the spindles. These are driven by a worm gearing from below. An eight-foot mandrel has only to be driven at about fifty revolutions per minute.

The author claims the following advantages: the copper is refined and manufactured into sheets or tubes in one operation, and is of a hard nature, similar to that which is cold-rolled; the process is at least ten times faster than any existing electrolytic process; a high current can be employed without deteriorating the quality of the copper; there is no risk of lamination; the plant is simple and free from mechanical complications; the amount of copper locked up for a given output is small compared to other processes; finally, anodes of very impure copper can be used as compared to the anode copper used in other systems.

By using a mandrel in which a V-groove has been indented, the spiral deposit that results can easily be pulled away, and then drawn down at once into wire, which can thus be made from crude copper in what is practically one operation.

The estimated capital expenditure and cost of working the "centrifugal" process are given in the paper.

Mr. A. Stanley Elmore (communicated) said the author had not mentioned heating the electrolyte as a method of accelerating the rate of deposition. He knew of one plant working the Wilde process in which the cathode was rotated rapidly, and the current density was by no means "comparatively low." He gave some further details regarding the Elmore process. The C. D. was occasionally pushed up to thirty amperes per square foot and has been carried up to over 200 amperes. A tensile strength as high as forty-two tons per square inch had been attained. By the use of a burnisher the same high C. D. could be used with a less expenditure of power than in other processes, and he claimed that by a combination of burnishing and moderate circulation of electrolyte better and more certain results could be obtained than by the author's "centrifugal" method. He asked how the author proposed to make tubes of less than two and one-half inches diameter.

Mr. Milbourne said that all that was claimed for the "centrifugal" process had been borne out by the results of the trials he had made with a practical plant on the Continent.

Mr. W. C. Prebble pointed out that in the author's process the circulation of electrolyte took place just at the place where it was most needed, namely, the surface of the cathode.

Mr. J. V. Mackenzie described an arrangement by which he had used current densities up to forty-five on electrotyping work.

Dr. C. J. Steinhart said that capital expenditure was an all-important item; whether that required in the "centrifugal" process remained within the permissible limits remained to be seen. The author had successfully surmounted the "early stage" difficulties of his process.

Mr. T. C. Cloud criticised the author's theory regarding the growth of nodules. He thought that the toughness of the metal was the result of the particles being drawn out into long fibres as they were being deposited.

Mr. Cowper-Coles replied to the various points raised. Tubes as small as two and one-half inches could not be deposited, but could easily be drawn down.

A paper on "The Use of Balanced Electrodes" by Professor W. W. Haldane Gee, was read in abstract by Mr. R. S. Hutton.

The method of ascertaining the weight of metal electrolytically deposited by directly weighing the cathode in the electrolyte instead of removing the cathode and weighing it—after washing and drying—is considered. The real weight (M) is obtained from the apparent weight (m) by the formula:

$$M = \frac{m\,\Delta}{\Delta - \delta}$$

where Δ is the density of the deposited metal, and δ that of the electrolyte. It is shown that since Δ occurs both in the numerator and denominator of the expression that for most purposes it is not necessary to know the value of Δ with great accuracy. In the case of copper the value of Δ that may be used is 8 9. An ordinary physical balance is used, and a cylindrical cathode suspended by a thin wire passing through a hole in the bottom of the balance case is counterpoised in the electrolyte. The anode also is circular, and surrounds the cathode. Electrical connection is made to the cathode by a side wire while receiving a deposit, but is removed when the apparent increase of weight has to be ascertained. The method has been found very convenient in testing commercial types of ammeters. An accuracy of about one per cent can be generally obtained, and with a little care and by increasing the amount of deposit the accuracy can be brought under 0.5 per cent. In some experiments both sides of the balance may be used simultaneously when the electrochemical equivalents of metals in different combinations may be compared and current efficiencies ascertained. A number of experiments have been made with a mercury cathode and

anode, the electrolyte being solutions of mercurous nitrate, or mercuric chloride mixed with potassium cyanide. The mercury cathode is enclosed within a shallow dish suspended in the electrolyte by a platinum wire. The anode is a layer of mercury at the bottom of the containing-vessel. In the case of mercurous nitrate it is shown that the current efficiency as a monad is affected by the presence of mercuric and basic compounds. For good results the mercurous nitrate solution must be carefully prepared and a strong solution used.

Modifications of the method are described that may be used for the purpose of finding the density of electrodeposited metals, and for studying the relative loss and gain at anode and cathode.

Instead of an ordinary balance a spring balance may be substituted. The author also shows how a Nicholson hydrometer may be used both as a cathode and as a means of finding the amount of deposit.

It is concluded that the method will be useful in the laboratory and test room as a means of rapidly arriving at results with sufficient accuracy for many commercial purposes.

Dr. F. M. Perkin said that the drawback to the use of mercury was that only small currents could be measured therewith. What was particularly wanted was an instrument that would indicate continuously; for example, the cathode might be suspended in a helix, to which a pointer was attached, as in the Ayrton-Perry meters.

Mr. H. D. Law and Dr. F. Mollwo Perkin contributed a paper on "The Electrolytic Oxidation of Hydrocarbons of the Benzene Series. Part ii, Ethyl Benzene, Cumene and Cymene," which was read in abstract by Dr. Perkin.

The authors have already shown that when hydrocarbons of the benzene series are electrolytically oxidized, that the aldehyde is in all cases the main product. This, however, is only the case when an appropriate solvent is employed; the only one which has given satisfactory results is acetone.

In continuation of the research the authors now show that when ethyl benzene is oxidized the chief product is the secondary alcohol, small quantities of the primary alcohol also being produced. Acetophenone, the second oxidation product, is not obtained, but benzaldehyde is produced when the oxidation is sufficiently prolonged.

With cumene the primary alcohol and the corresponding aldehyde are produced. The isopropyl group in cumene, however, shows itself relatively stable toward electrolytic oxidation.

Cymene gives chiefly cumic alcohol and cumic aldehyde, the methyl group in the paraposition to the isopropyl group being attached in preference to the latter.

In discussing the results the authors consider that the hydroxl ion or discharge is the oxidizing agent; in other words, the oxidation is mainly a primary reaction. The work is being continued.

Dr. H. Borns referred to the possibility of arresting the oxidation at intermediate stages.

Mr. H. D. Law and Dr. F. Mollwo Perkin also presented a note on "The Electrolytic Analysis of Antimony."

Owing to the trouble of preparing the sodium sulphide solutions necessary for electrolyzing antimony solutions by the method of Classen, the authors recommend the use of a solution containing ammonium tartrate, which they have found to give very satisfactory results.

Mr. J. H. Belcher said that he had used the ammonium tartrate solution with success.

Mr. R. S. Hutton and Mr. J. R. Beard communicated some "Notes on Heat Insulation, Particularly with Regard to Materials Used in Furnace Construction."

Despite the evident technical importance of the subject, very few measurements of the heat conductivity of firebrick and other materials used for furnace linings have been made.

The authors have carried out a number of determinations chiefly with granular materials such as magnesia, carborundum, sand, and firebrick. By adopting an apparatus devised by C. H. Lees and J. D. Chorlton, they have been able to measure the conductivity of such powders at temperatures up to 100 degrees centigrade. The chief results are summarized in the following table:

	Conductivity.
Sand (white Calais)	0.00060
Carborundum	0.00050
Firebrick	0.00028
Lime	0.00029
Magnesia (fused)	0.00047
Magnesia (light calcined)	0.00016
Infusorial earth	0.00013

In order to compare the insulating power of these materials under conditions more nearly approaching those met with in practice, a small electrically heated tube furnace was surrounded with the various granular powders. Measurements of the power expended and the temperature attained in the individual cases clearly show the comparative value of the insulating materials examined.

From these experiments one can get some idea of the saving in heating costs, whether these are incurred in providing fuel or electric energy, which could be effected by a suitable choice of a furnace-jacketing material. Some of the best insulators are not suitable for really high temperatures on account of their shrinkage. Even under these conditions, however, they can often be used to advantage in conjunction with some more stable but less good insulator which serves for an internal lining of the furnace.

Mr. C. R. Darling (communicated) referred to some heat insulation tests carried out by Professor S. P. Thompson and Professor Dalby, in which, unlike the authors' tests, a steady internal temperature was maintained, and the amount of heat escaping in a given time measured. The relative insulating values were proportional to the watts expended in keeping the temperature constant.

Mr. R. S. Hutton said that Mr. Darling's method was unsuitable for high temperature tests.

Mr. R. W. Vicarey presented a paper entitled "Storage Batteries and Their Electrolytes," which was taken as read.

This is a paper intended by the author to be a résumé of observations and experiments referring to the deleterious effect of nitrogen compounds (especially ammonia) upon the durability, efficiency, and behavior of storage batteries.

The paper deals with the action of ammonia and other nitrogen salts, and the salts of potassium, sodium, aluminum, magnesium, and calcium, and it discusses their uses in the various manufacturing processes. It also deals with the waters and acids used for the electrolytes of batteries.

It would appear that ammonia must be considered as a dangerous impurity, the total absence of which, however, can not be absolutely insisted upon. The presence of ammonia in the surroundings or neighborhood of the cell must be carefully guarded against, and the percentage actually present in the cell must be kept as low as possible by the use of waters and acids of the purest quality.

The author points out that above certain limits of ammonia little difference is observed in the behavior of cells, but that below that limit much difference occurs. Thus experiments upon cells containing proportions of ammonia varying from ten per cent to 0.1 per cent (7040 to 70.4 grain per gallon), the loss in capac-

ity was twenty-two to thirty-one per cent immediately after the addition of the ammonia, while cells containing less than 0.1 per cent did not drop in capacity immediately, but varied intermittently from ten to fifteen per cent, finally settling at the end of eight months to a permanent loss of fifteen to twenty-two per cent.

From the data given it appears that ammonia is very slow in its action before it makes any appreciable or apparent loss in the capacity of the cells, the average time being about twelve months, dating from the initial charge.

The effects of ammonia in its various combinations appear principally in two distinct forms: (1) it causes an excessive disintegration or shedding of active material at the positive (PbO_2) plate; (2) it becomes deposited upon the negative (spongy) plate, and finally closes up the pores of the active material, thereby causing a decrease in the ampere-hour capacity or efficiency varying from ten to sixty per cent in about twelve months.

The use of water taken from the steam boiler and termed "distilled" is mentioned as a dangerous practice that is common in central stations, etc.

The position of the battery and its surroundings are also touched upon.

Finally, it is proposed that a series of experiments be carried out upon some cells in an attenuated atmosphere away from all manufacturing districts.

Professor E. Wilson presented a paper on "Alternate-Current Electrolysis." This was taken as read, and the discussion postponed until the autumn.

A Great Conference at Detroit.

The twelfth International Conference of Railroad Young Men's Christian Associations, to be held in Detroit, September 28 to October 1, bids fair to exceed in interest and attendance any of the previous gatherings, all of which have been unique.

Eleven such conferences have been held, beginning in 1877, the most important being those at Clifton Forge (1895), Philadelphia (1900), and Topeka (1903), attended respectively by 469, 1,170 and 1,476 delegates.

The list of delegates at the last conference shows the wide extent of railroad men's interest in this work. There were present nine hundred and forty-four engineers, clerks, conductors, brakemen, trainmen, shopmen, trainmasters, yardmasters, despatchers and operators, ticket, freight and other agents, together with two hundred and fourteen men representing forty-one other railroad occupations.

These gatherings have a character all their own. The prompt energetic men who compose them do not leave a minute unfilled with enthusiasm. Deep religious impression is made on heart and life. Increased and more varied activity in many local fields has sprung from the inspiration brought home by delegates.

Already arrangements have been made with prominent speakers, including the Hon. H. B. F. Macfarland, of Washington; Rev. John Potts, D. D., of Toronto; Robert E. Speer, John R. Mott and Edmund W. Booth. A number of other representative men are expected to address the delegates. Government and railroad officials will be present at the Friday evening session. John J. McCook, chairman of the international railroad committee, will preside over the conference.

Ladies of Detroit will extend to the delegates a welcome reception during the conference. An excursion and other recreative features will be arranged for Saturday afternoon.

The number of delegates at Detroit may reach eighteen hundred. Of late years railroad work has made marked progress along the Grand Trunk, and many Canadian delegates are expected.

The novel feature of the conference will be the holding of shop meetings on Friday noon, in from fifty to seventy-five railroad and industrial plants of Detroit, these meetings to be conducted by railroad delegates who have been identified with such meetings elsewhere. Each leader will be accompanied by a singer or quartette, and the singing will be a feature of the services. It is hoped that at least 10,000 men may be reached by these meetings.

In the evening meetings the stereopticon will be used and the seventy-five or more buildings erected during the past five years will be shown on the screen. Other attractive slides will be presented, together with a number of moving pictures.

Interesting musical features will be the presence of an orchestra composed of railroad men, and of various quartettes and glee clubs. But the vigorous singing by the great body of male voices will be still more striking.

The interest of the last two conferences has been greatly increased by the presence of several representatives of foreign countries, in some cases sent officially by their governments. Similar representatives are expected at Detroit. President Roosevelt gave a stirring address at the Topeka conference, expressing, as always, his high appreciation of railroad men.

The conference will be self-entertaining, the Detroit association arranging for reservations for the delegates.

Of late years the extension of this work to countries where it is now unknown has held a prominent place in the regard of many railroad associations. The starting of an association in the city of Mexico, composed largely of railroad men, was effected through the sympathetic gifts of railroad men in the United States and the Dominion of Canada. A recent member of the Kentucky state committee's force was sent, during the past year, to inaugurate similar effort in India, under the direction of the Indian national council of the associations. He reports a hearty reception by many railroad officials, who manifest great interest in the proposed work. A number of these men, in connection with their attendance at the recent Railway Congress in Washington, visited several American associations and carefully studied their work.

The conference will close on Sunday, October 1. A meeting for delegates will be held at nine o'clock, before the regular church services. It is expected that representatives will speak in every one of the seventy-five churches of the city. The afternoon meeting for railroad men in the Light Guard Armory will be conducted by Fred B. Smith, who is considered to be the best leader of such meetings now on the platform. Evangelistic meetings will be held in a number of the churches in the centre of the city at 7.30. The concluding service will be a farewell meeting for delegates at 9.15 in the Central Methodist Church.

The printed report of the Detroit conference, like those of former conferences, will give a detailed and lively picture of the entire meeting.

Detroit is a very attractive and accessible city. A large share of its many churches are located near together, which is very convenient for conference purposes. The Light Guard Armory is readily transformed into a capital meeting-place for a multitude of people and the citizens are famous for the admirable local arrangements they always make for a convention.

Report of the Sixth Annual Meeting of the National Electrical Trades Association.

The report of the sixth annual meeting of the National Electrical Trades Association, held at Montreal, Canada, June 23, 1905, has been printed in full and is being distributed to the members of the association. In addition to the customary reports the book contains a list of members.

Electricity in the Coast Defense.

A School Where Officers of the Artillery of the United States Army Are Taught How to Use Electricity in War.

THE entire world has been surprised by the important part which electricity has played in the war now being carried on in the Far East. The greatest attention has perhaps been drawn to the use of electrical methods of communication. During the early stages of the war wireless telegraphy was used extensively. Later, when the land campaigns were begun, it soon became apparent that the telegraph and the telephone were largely supplanting the old courier system and greatly modifying the methods of transmitting orders and carrying out desired movements. These uses of electricity are vitally important, and are generally delegated to the signal corps. But it is the use of electricity in another division of the army to which attention is called here.

OFFICERS' SCHOOL, SCHOOL OF SUBMARINE DEFENSE, FORT TOTTEN, NEW YORK.

We are protected in two ways from foreign invasion: first, by the navy, second, by the coast defenses which have been erected to protect every important harbor. The responsibility for the coast defenses rests with the artillery. The military engineers may plan and build a fortress, but the artillery must hold it, defend it, and beat off hostile attacks. In the modern way of doing this electricity is becoming one of the most important factors.

There are two ways of defending a harbor which comes under the artillery's care. The one is by mining, the other by gun fire. Mines may be of several kinds. For defending a harbor they are generally anchored in known positions. In general, they consist of large pressed steel vessels having either a spherical or cylindrical form. Within them is placed a charge of a high explosive, which, in some classes of mines, would be detonated by coming in contact with a vessel, or which might be harmless until fired by means of an electric current controlled from the shore. The two types may be combined so that the mine may be fired either by contact or from the land.

Those mines which are fired electrically necessarily call for careful work, not only in arranging the firing device, but in connecting this to the firing station on land by means of a submarine cable. These cables are led to a controlling switchboard placed in a building well out of danger from hostile fire, and here is stationed the officer, who, at a given signal, fires the designated mine. The switchboard to which the mine cables run provides not only for firing the mine, but for testing its condition at any time. The power supply must be always ready for use at a moment's call.

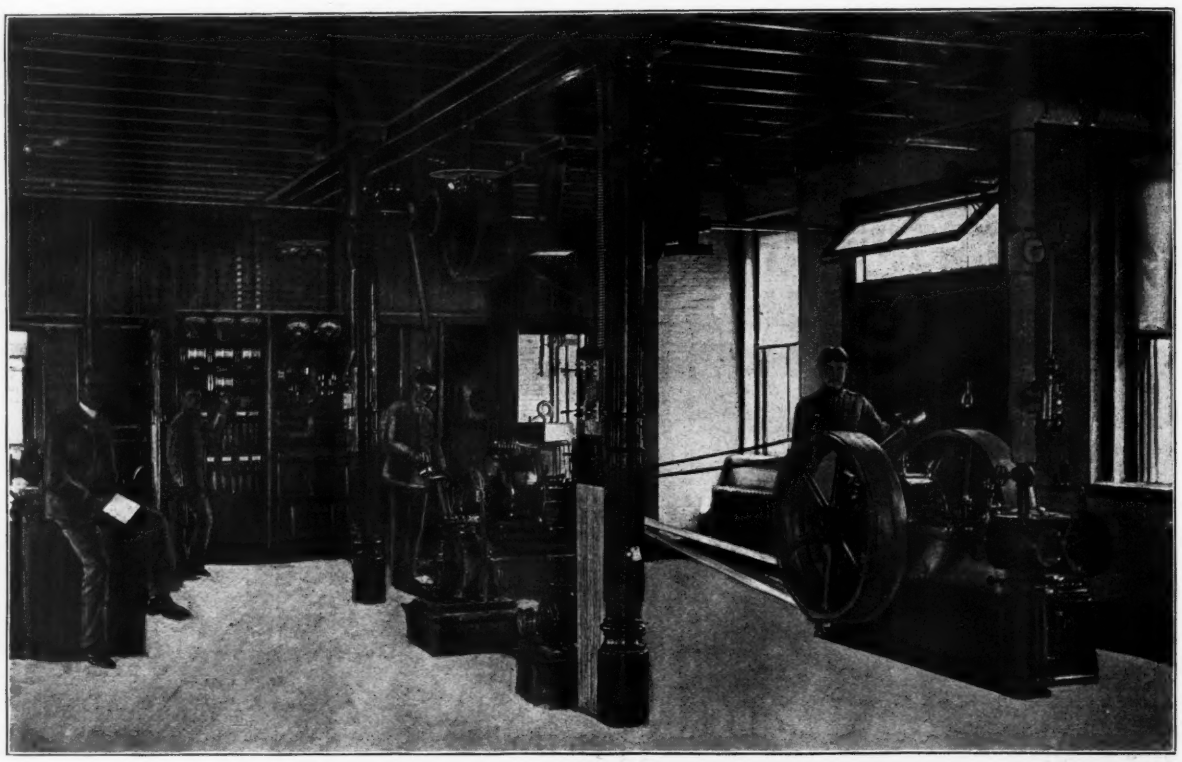
There are several ways by which the signal to fire a mine may be given. The vessel itself, by striking the mine, may give the alarm which leads to its destruction, or the method known as judgment firing may be adopted. The simplest way, of course, would be to use contact mines which would explode as soon as struck, but the objection to these is that they are nearly as dangerous to friends as to foes. Those mines which can be fired from the shore may be perfectly harmless until the firing current is sent through them. They can be set off even though the hostile ship be not in contact with them, and thus disable it. In the method known as judgment firing a range-finder is placed in a fire-control station at some point which commands the waters which have been mined. The position of every mine is

carefully plotted on a chart, so that if the location of a hostile vessel be known, it will at once be seen whether she is in proximity to a mine. Upon the approach of a vessel she is watched by the range-finder, who not only determines her direction from the station and her distance, but the course she is following and her speed. He plots this on the chart and estimates which mine the vessel is approaching and the exact time when she will reach it. Allowing a definite time for transmitting the order by means of a telephone and for the officer at the other end to close the switch, he gives a signal when he thinks the vessel will be over the mine by the time it is fired. Naturally, operations of this kind can only be conducted satisfactorily and surely after a great deal of practice. Not only must the officers and men be drilled thoroughly in the work, but they must be entirely familiar with the system and with all the apparatus. Then, too, the handling of the electrical devices employed requires much skill. A marine cable such as must be employed is itself a more or less delicate object. It demands that it be treated with consideration. When joints are to be made, they must be made properly if satisfactory results are to follow. A job hastily done might suffice if the cables were to be used immediately, but a mine must be put down so that it can remain in perfect condition for weeks, possibly months, and yet always be ready for instant use.

The second class of defensive work is in the training and firing of coast-defense guns. These are naturally large and powerful, yet they must be handled quickly and delicately. For this purpose the electric motor is being introduced in our coast defenses. The firing of the guns, in case of an attack, would, in general, be controlled from a station, somewhat in the same way as is the firing of the mines. The gunner would be given the range. He would then train his gun and would fire upon a signal from the station. Or the gun might even be fired by the commanding officer himself, who would naturally be at the fire-control station.

As electricity is becoming such an important factor in the artillery service, it is essential that there should be available a large number of officers who are thoroughly trained electrical engineers. For training these men the Department of Electricity and Mines has been established at the School of Submarine Defense, Fort Totten, N. Y. A well equipped laboratory has been erected, one floor of which is devoted to electrical work, and the other floor to the department of chemistry and explosives. The front of this building contains a lecture room and a room for general electrical measurements. In the rear are the machinery, laboratory and power-house, where there are a number of dynamos, motors and motor-generators which make available any character of electric current desired.

The young men who take this course are all graduates of West Point and officers who have had several years' service in the army. The course consists of practical work supplemented by parallel reading and study of reference books laid upon the former, and everything is done to make it as practicable as possible. The men learn about electrical machinery from actual handling and use of it. They learn how to splice cables and make joints by doing the work itself. They learn how to load mines and insert firing plugs in the same way. Mines are loaded and placed, and everything made ready as though they were to be used. Training is also given in the use of the telephone and the telautograph, which is now being employed as an auxiliary to the telephone. They are taught the care and inspection of electrical material, the testing, management and inspection of dynamos and storage batteries, and they are expected to know how to manage engines and boilers. All of this work is, of course, in addition

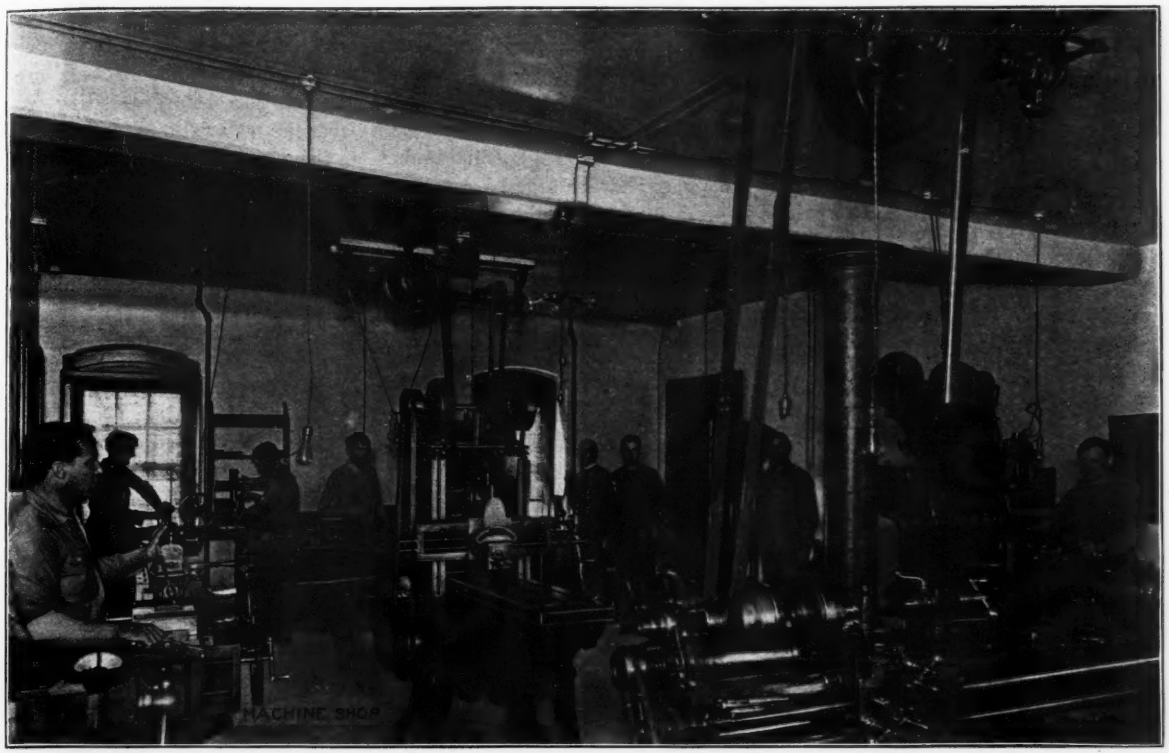


POWER ROOM, SCHOOL OF SUBMARINE DEFENSE, FORT TOTTEN, NEW YORK.

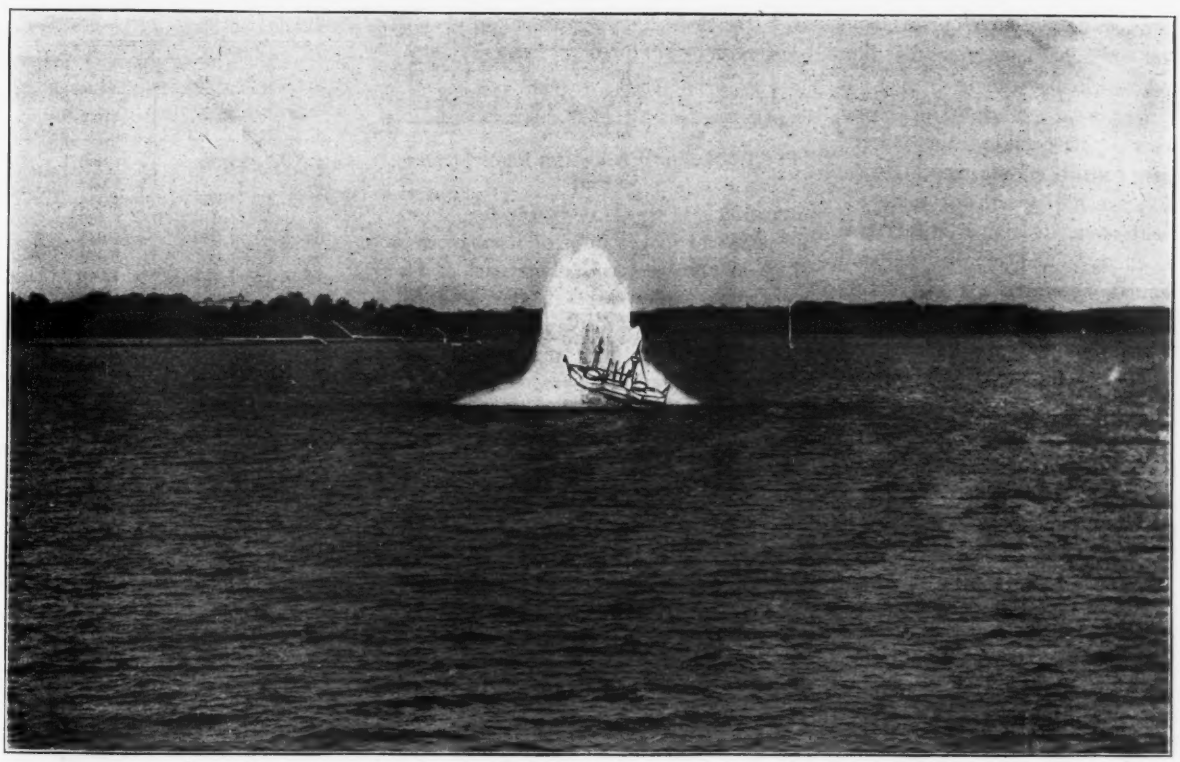
to much other training which does not come under the head of electricity.

certain number of men as expert electricians. Those who follow this course are

construction of all kinds of electrical apparatus, and taught how to erect and re-



Machine Shop, Electrician-Sergeants' Department, School of Submarine Defense, Fort Totten, New York.



Judgment Firing—After Explosion, School of Submarine Defense, Fort Totten, New York.

In addition to this school for officers there is at Fort Totten a school for electrician-sergeants. This is for training a

all picked men, and they are given a thorough training in shopwork of all kinds. They are made familiar with the

pair them. For this purpose the laboratory is fitted with telephone and telegraph instruments, switchboards, searchlights

and all other appliances which are used. The idea is to make this branch of the army independent and entirely self-reliant, a result which can only be reached when both officers and men have been thoroughly trained in the work they must do.

To bring about this result the course now laid out at Fort Totten is excellently adapted. The chief need of the school is a larger and more complete equipment. Although the material now in the laboratory is excellent for its purpose, the developments in the use of electricity in warfare are taking place so rapidly, and are becoming so all-important, that there is the greatest need for a larger and more complete installation. The time of war is not the time for preparing for defense. We could have no greater security than would come to us by fitting each and every fort along the coast with modern apparatus. It will take time to do this, and the time to do it is now. To care for this apparatus during peace, and to use it in time of war, will need a large body of trained men. The School of Submarine Defense at Fort Totten is supplying the latter need as rapidly as its facilities will permit; but when it is stated that to operate the power plants, electrical appliances and mine system requires about 200 officers and 5,000 men, we realize that the rate at which they can be turned out at Fort Totten is far too low. The present class which is now taking the officers' course there consists of ten men. In the electrician-sergeant department there are twenty-eight men. Obviously, the school should be enlarged and supplied with all the appliances necessary for instructing the officers in the duties which they may be called upon to perform. These men will play a most important part in the successful operation of our coast defenses.

So important and universal are the applications of electricity in coast defense, it is considered that all officers should have some knowledge of it. Therefore a course in electricity is also required at the Artillery School, Fortress Monroe, Va. There fifty lieutenants are constantly under instruction, but the course is short. When it is considered that there are about 600 officers of artillery, it will be seen that the army facilities for this important work need amplification and extension.

"A penny wise, pound foolish" policy which pares down appropriations intended for this purpose is certainly not that most suited to our safety and dignity.

ON THE MAGNETIC QUALITIES OF SOME ALLOYS NOT CONTAINING IRON.[1]

BY J. A. FLEMING AND R. A. HADFIELD.

The exhibition by one of us (Mr. R. A. Hadfield) at the British Association meeting at Cambridge in 1904 of a sample of a magnetic alloy first prepared by Dr. Heusler, composed of copper, aluminum, and manganese, having aroused considerable interest, we felt that the quantitative measurement of the principal magnetic constants of such a material would be of very considerable interest. We, therefore, undertook at the earliest moment experiments with this object in view, and the following paper contains an account of the preliminary results obtained.

For the purposes of exact magnetic

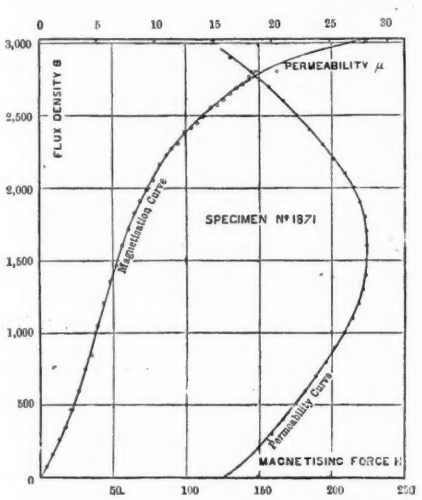


FIG 1.—MAGNETIZATION AND PERMEABILITY CURVES.

measurements it was necessary to prepare the material in the form of homogeneous rings in regular form. This part of the work was undertaken at the Hadfield Steel Works, Sheffield, and in the early part of January, 1905, two such rings of alloys not containing iron were sent to the Pender Electric Laboratory of University College, London, for the magnetic tests. These two rings were respectively numbered No. 1871 and No. 1888/7. Their chemical constitution was as follows: the ring No. 1871 had the following composition: manganese, 22.42 per cent; copper, 60.49 per cent; aluminum, 11.65 per cent. There is a certain amount of intermingled slag, probably two or three per cent, mostly consisting of MnO and SiO_2 and slight traces of other metals. Analysis showed that there was present also: carbon, 1.5 per cent; silicon, 0.37 per cent; and iron, 0.21 per cent. Hence it may be said that nothing but a trace of iron occurs in this sample of alloy. The other ring, No. 1888/7, had an approximate composition: manganese, eighteen per cent; copper, sixty-eight per cent; aluminum, ten per cent; lead, four per cent. These alloys unfortunately have poor mechanical properties and are brittle and can not be forged. Rings were cast from the material and turned in the lathe to the desired form. The rings have been carefully shaped, their dimensions were then measured. Both rings had approximately a mean diameter of 12.4 centimetres and a square cross-section of approximately one centimetre axial depth and one centimetre radial breadth. Each ring had four diametral lines, marked on it at angular intervals of forty-five degrees. As the ring No. 1871 was very slightly tapered, measurements were made on the front and back face and the means taken as follows:

[1] Paper read before the Royal Society, of London, on June 8.

OUTSIDE DIAMETER OF RING NO. 1871.

Along Diameter.	At Back in Cms.	At Front in Cms.	Mean in Cms.	
1—5	12.390	12.360	12.375	Mean outside diameter = 12.3765 cms.
2—6	12.284	12.358	12.371	
3—7	12.392	12.368	12.380	
4—8	12.390	12.370	12.380	

The axial depth and radial breadth were then measured in the same eight positions:

Position.	Breadth.		Depth.
	Back.	Front.	
1	1.056	1.050	1.060
2	1.056	1.044	1.052
3	1.058	1.044	1.058
4	1.058	1.050	1.062
5	1.060	1.042	1.056
6	1.064	1.046	1.058
7	1.062	1.046	1.058
8	1.064	1.042	1.054

The resulting mean dimensions of the ring are as follows:

RING NO. 1871.

Mean outside diameter	12.3765 cm.
Mean inside	10.2713 "
Mean breadth	1.0526 "
Mean depth	1.0572 "
Area of cross-section	1.1129 sq. cm.
Length of magnetic circuit or mean perimeter	35.576 cm.

The ring was then carefully wound over with primary and secondary electric circuits. These consisted of double silk-covered copper wire, well insulated with shellac varnish. The ring was first given a coat of shellac varnish made up with absolute alcohol and after drying was wound over with four separate secondary circuits, placed in the four quadrants. These each consisted of one layer of silk-covered copper wire (No. 30 S. W. G.) and were numbered respectively 1, 2, 3, and 4.

The turns were counted by more than one observer, and after varnishing and drying the outside width and depth over the winding was again measured so as to calculate the excess of the area included by the median line of each secondary wire turn, over and above the cross-sectional area of the ring of alloy itself. The results were as follows:

Secondary Coil.	Number of Turns of Wire in Coil.	Mean Outside Depth in Centimetres Over Winding.	Mean Outside Breadth, in Centimetres Over Winding.
1	208	1.154	1.1415
2	197	1.152	1.137
3	204	1.150	1.140
4	207	1.150	1.135

The secondary coils were then covered with a layer of silk tape and varnished, and after drying, the primary magnetizing coil was wound on in three layers. This consisted of No. 18 double cotton-covered copper wire, the three layers having respectively 217, 206, and 197 turns. Between each layer a winding of varnished silk tape was interposed. The ring so wound over uniformly with secondary and primary coils was mounted on a board with screw terminals at the ends of the various circuits. From the dimensions taken, the mean area included by the central line of one turn of the secondary circuit can be calculated, and it is 1.2097 square centimetres. Since the mean cross-sectional area of the ring is 1.1129 square centimetres, the difference between these two must be reckoned as an air space which is traversed by the magnetic flux due to the primary coil alone.

The magnetic measurements were made in the usual way with a ballistic galvanometer. A Paul movable-coil ballistic galvanometer, having a periodic time of about four seconds, was employed. The secondary coil on the ring was joined in series with the galvanometer coil, with a resistance box and with a secondary standardizing coil, which last was inserted in the interior of a long helix or primary standardizing coil, in which a known magnetic field could be created by a measured current. The currents were measured by a potentiometer. The usual methods were adopted for determining the magnetization curve and the hysteresis loops of a sample of magnetic material in the form of a ring. A known primary current was reversed through the primary coil on the ring and the throw of the ballistic galvanometer observed. The meaning of the deflection was interpreted by breaking or reversing a measured current through the primary standardizing coil. It is not necessary to enter into details of the arrangements, as they are familiar to every one in the habit of using the ballistic galvanometer for magnetic measurements.

The cyclical magnetization curves were, in all cases, taken by applying to the ring a known maximum magnetizing force, and then dropping suddenly from this to a smaller value in the same direction, or to one in the opposite direction. In this manner the change in the flux, passing through the secondary coil in passing from a certain maximum flux to a lesser or oppositely directed flux, was determined and the cyclical magnetization curves set out as usual. Since the area included by the median line of one turn of the secondary circuit exceeds slightly the actual cross-sectional area of the ring, a necessary correction was applied in reducing the observations to obtain the true flux density in the metal itself from the observed or apparent flux density as calculated from the galvanometer deflections. If B′ is this observed flux density, B the true flux density, and H the magnetizing force, then from the dimensions given above we have $1.1129\ B = 1.2097\ B' - 0.0968\ H$.

In the first set of observations an ordinary magnetization curve was taken, with gradually increasing magnetizing forces (H), the flux density (B) being measured by reversing the force at each stage, and the corresponding permeability values (μ) being calculated for each value of B. The reduced figures of observation are given in table i.

A second magnetization curve was subsequently taken, carrying up to force to a much higher limit—*viz.*, 225 C. G. S. units, as far as it was safe to go without destroying the insulation of the primary coil. The figures obtained are given in table ii.

TABLE I.

MAGNETIZATION CURVE OF MAGNETIC ALLOY NO. 1871, TAKEN WITH MAGNETIC FORCES VARYING FROM 1 TO 50 C. G. S. UNITS.

Magnetizing Force in C. G. S. Units.	Magnetic Flux Density in C. G. S. Units.	Permeability.
H.	B.	μ.
1.10	18.6	16 9
2.19	32.45	14.8
3.28	56.90	17.35
4 28	77.7	18.15
5.48	100.05	18.25
6.57	122.4	18.65
7.66	144.4	18.86
8.46	167.5	19.8
9.86	192 3	19 52
10.95	218.0	19.9
12.04	238.5	19.8
13.14	270.0	20.54
14.23	294.8	20.7
15 32	322 0	21.06
16.41	351.6	21.4
17.50	385.0	22.0
18 60	419.0	22.5
19.70	464.0	23.32
20.80	496.5	23.84
21.90	530.0	24 2
23 0	564.0	24.5
24.1	599.0	24 82
25 2	636 0	25.22
26.28	659.0	25.05
27.4	703.0	25.64
28 5	738.0	25.88
29.6	780.0	26.35
30.7	811.0	26 4
31.8	845.0	26.56
32.85	877.0	26.7
33.95	922 0	27.15
35.05	955.0	27.24
37.25	1,030.0	27 66
39.45	1,096.0	27.78
41.6	1,162.0	27.94
43 9	1 236.0	28.15

TABLE II.

MAGNETIZATION CURVE OF MAGNETIC ALLOY NO. 1187, TAKEN WITH MAGNETIC FORCES VARYING FROM 4 TO 225 C. G. S. UNITS.

Magnetizing Force in C. G. S. Units.	Magnetic Flux Density in C. G. S. Units.	Permeability.
H.	B.	μ.
4.36	75 64	17.36
8.74	160.21	18.34
13.12	260.56	19.88
17.45	344.33	19.73
21.83	467.9	21 43
26.23	597.96	22.80
30.77	749.21	24.35
35.26	844.36	23 95
39 47	1,054.0	26.70
43 86	1,207.1	27.53
48.15	1,358.1	28 20
52.63	1,463.9	27.79
57.04	1,604 9	28.13
61.36	1 714.3	27.94
65.58	1,828.1	27.87
69.83	1,911.0	27.37
74.28	1,986.9	26.75
78.57	2,049.5	26.09
83.21	2,163.1	26.00
88.20	2,221.0	25.18
91.80	2,272.7	24.76
95.98	2,303 5	24 00
100 33	2,385.0	23.77
104.92	2,412 9	22.99
109.49	2 441 3	22.30
113.71	2,497 1	21.96
118.26	2 552 7	21.59
122.93	2,571.6	20.92
127.0	2,606.1	20.52
131.68	2,662.7	20.22
136 0	2,690.3	19.78
140.09	2,716.7	19 39
144.79	2,773.0	19.15
149.42	2,799 0	18.73
163 5	2,802.0	17.14
225.43	3,013.1	13.36

The observations recorded in table ii are plotted into a curve in Fig. 1, and show that the magnetization curve for this magnetic alloy possesses all the well-known characteristics of a magnetization curve of the ferromagnetic metals—iron, nickel, or cobalt. They show also that the permeability is a function of the flux density, and has a maximum value of nearly twenty-eight.

The next step was to take a number of cyclical magnetization curves, carrying the material through a magnetic cycle of operations, and employing various and increasing maximum values for the magnetic force.

In the tables iii to ix below are recorded the reduced results showing the magnetic force and corresponding flux

density in the case of the various cycles, the maximum value of the magnetic force in either positive or negative direction being given for each cycle. The results of all these observations are embodied in a series of hysteresis loops or cyclical magnetization curves, which are given in Fig. 2. The range of maximum magnetic force for the various cycles extended from ten to seventy C. G. S. units.

TABLE III.

CYCLICAL MAGNETIZATION CURVE FOR MAGNETIC ALLOY NO. 1871. MAXIMUM VALUE OF MAGNETIZING FORCE = 10 C. G. S. UNITS.

Force Positive and Decreasing.		Force Negative and Increasing.	
Magnetizing Force in C. G. S. Units.	Magnetic Flux Density in C. G. S. Units.	Magnetizing Force in C.G.S. Units.	Magnetic Flux Density in C. G. S. Units.
+H.	B.	−H.	B.
9 06	170 4	1.095	5.69
7.92	149.9	2 256	22.95
6 68	131 2	3.329	46.7
5.59	115.7	4 46	69.03
4.43	96.32	5.598	92.08
3.255	77.22	6.627	115.15
2.186	57.73	7.726	138.2
1.09	37.87	9.023	167.0
0.0	16.32	10.0	184.3

The numbers under the column headed + H are the gradually decreasing but positive values of H, to which the force is reduced each time from the maximum value + 10. The numbers under the heading — H are the negative values of H, to which the force is suddenly changed from + 10.

The corresponding values of B delineate one-half of the hysteresis loop.

TABLE IV.

MAXIMUM VALUE OF MAGNETIZING FORCE = 20 C. G. S. UNITS.

+H.	B.	−H.	B.
17 42	413.4	2.81	61.85
15.496	385.0	4.44	6.00
13.17	347.6	3 69	49.85
10.96	310.6	8 90	105.7
8 796	275.2	10.95	161.5
6 633	233 8	13.16	217.4
4.44	195.5	15 48	295.6
2.295	163 2	17.45	351.6
0.0	106.5	20.0	452.1

TABLE V.

MAXIMUM VALUE OF MAGNETIZING FORCE = 30 C. G. S. UNITS.

+H.	B.	+H.	B.	−H.	B.	−H.	B.
28.48	753.6	13.21	521.45	2.46	199.27	17.63	242.76
25.57	713.35	10.97	492.36	4.47	142.66	19.64	355.1
23.76	684.2	8.87	447.16	6.68	86.58	21.88	468.8
22 19	660.3	6.61	401.92	8.86	19 03	24.41	551.7
19.74	627 9	4.39	356.4	11.17	48.9	26.55	666 4
17.86	598 3	2.46	322.15	13.15	128.0	28.43	745.75
15.53	561.08	0.0	263.38	15.24	157.0	30.00	773.8

TABLE VI.

MAXIMUM MAGNETIZING FORCE = 40 C. G. S. UNITS.

+H.	B.	+H.	B.	−H.	B.	−H.	B.
37.01	1,077.0	17.23	801.9	2.64	385.8	19.45	203.88
34 21	1,042.7	14.69	762.7	4.29	343.1	21.65	319.98
32.32	1,019.0	12.82	728.0	6.36	286.0	24.25	423.68
29.51	979.1	10.67	694.2	8.89	208.6	25.33	456.8
27.77	954.6	7 93	643.2	10.98	141.8	27.72	568.8
25 39	920.1	6.01	603.6	13.02	72.5	30.58	705.5
23.39	897.8	3.78	558.4	15.28	24.82	33.94	867.4
21.05	864.3	2 64	521.2	15 30	21.47	36.68	975.1
18.89	829.8	0.0	464.9	17.2	102.83	40 00	1,112.0

TABLE VII.

MAXIMUM MAGNETIZING FORCE = 50 C. G. S UNITS.

+H.	B.	+H	B.	−H.	B.	−H.	B.
46.87	1,388.8	24.91	1,122 0	5.50	542 4	34.69	772.8
45.56	1,376.1	22.33	1,085.0	8.47	452.9	38.36	918.0
43.16	1,350.8	20.73	1,053 9	12.92	292.86	43.67	1,144.0
40.88	1,327.1	18.67	1,031.8	17.77	87 59	45.66	1,253.9
39.01	1,303 8	17 04	999.4	22.15	132.1	48.0	1,364.0
35 58	1,264.6	15 26	975.5	26.52	331.1	50 0	1,419.3
33.89	1 457.7	13.69	922.1	30.03	522.0	....	....
32.35	1,221 9	5 91	830 9	....	....	....	....
30.10	1,189.3	4.25	763.8	....	....	....	....
23.13	1,167 3	0.0	674.8	....	....	....	....

TABLE VIII.

MAXIMUM MAGNETIZING FORCE = 60 C. G. S. UNITS.

+H.	B.	+H.	B.	−H.	B.	−H.	B.
55.05	1,561.5	27 56	1,236.2	6.56	351.74	36.17	807 0
54.56	1,559.1	22 25	1,158.5	10 62	406.01	40.88	1,003.0
50.05	1,509.6	19.73	1.122 0	15.16	240.29	45.53	1,273.0
45.37	1,460 4	14.2	1,025 3	19.52	62.0	50 15	1,449.8
40.58	1,406 8	9 97	956.4	23.61	132.9	53.16	1,557.3
36 10	1,349.0	5.73	868.6	28 29	381.6	54.93	1,613.1
32.35	1,299 6	0.0	745.8	31.68	560.0	60.0	1,612.9

TABLE IX.

MAXIMUM MAGNETIZING FORCE = 70 C. G. S. UNITS.

+H.	B.	+H.	B.	−H.	B.	−H.	B.
65 17	1,859.9	31.60	1,495.5	5.87	769.1	55.14	1,457.8
61.42	1,823.6	22.40	1,350.6	13.88	487.2	63.33	1,693.7
55 29	1,763.2	13.51	1,206.0	23.52	18.8	65.65	1,797.5
50.52	1,706.0	8.64	1,115 8	32.14	429.4	66.35	1,855.3
45.94	1,664.0	....	925 6	40.12	790.2	68 65	1,855.1
40.75	1,604 1	....	....	49.14	1,292.0	70.0	1,904 9

The figures in the above tables having been set out in the form of hysteresis loops or cyclical magnetization curves, the areas of these curves were taken in square centimetres, and by division by 4π the energy loss in ergs per cubic centimetre per cycle of magnetization was obtained. The final results are set out in table x.

From the figures in table x a curve can be set out (see Fig. 3) which delineates the relation between E and $B_{max.}$, or the energy expenditure required to carry the magnetic alloy through one complete magnetic cycle of operations, and the maximum value of the flux density during that cycle. This curve is shown in Fig. 3 (on the left hand) as a curve concave upward. If, instead of plotting in terms of E and $B_{max.}$ as taken from

TABLE X.

CYCLICAL MAGNETIZATION CURVES AND HYSTERESIS ENERGY LOSSES PER CYCLE OF MAGNETIC ALLOY NO. 1871.

Maximum Value of the Magnetizing Force in C. G. S. Units in Each Cycle.	Maximum Value of the Flux Density in Each Cycle.	Energy loss in Ergs per cub.cm. per Cycle =area/4 π.
$H_{max.}$	$B_{max.}$	E.
10	184.3	35.02
20	452.1	464 8
30	773.8	1,589.2
40	1,112.0	3,600.4
50	1,419.3	6,336 0
60	1,613.0	7,258.0
70	1,859.9	10,880.0

table x, we plot the logarithms of these quantities, we obtain nearly straight line, as shown on the right-hand side of diagram 3.

The values in table x show that the energy loss per cycle may be represented as an exponential function of the maximum flux density by an expression of the form

$$E = \eta B_{max.}^{n}$$

where n is some exponent and η some constant.

We find the numerical values to be best represented by the expression

$$E = 0.0005495\ B_{max.}^{2.238}$$

The exponent n in the case of iron, nickel, and cobalt is a number not far from 1.6. In the case of this alloy the hysteretic exponent between $H_{max.} = 10$ and $H_{max.} = 70$ has a much higher value, *viz.*, 2.238.

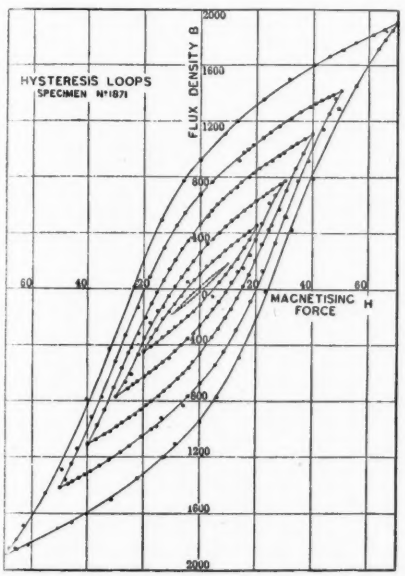


FIG. 2.—HYSTERESIS LOOPS OR CYCLIC MAGNETIZATION CURVES.

From the above observations we are then able to draw the following conclusions:

1. The alloy No. 1871, composed of copper, aluminum, and manganese, in the proportions mentioned above, exhibits magnetic properties which are identical with those of a feebly ferromagnetic material.

2. The magnetization (or B, H) curve is of the same general form as that of a ferromagnetic metal such as cast iron, and indicates that with a sufficient force, a state of magnetic saturation would most probably be attained.

3. The alloy exhibits the phenomenon of magnetic hysteresis. It requires work to reverse the magnetization of the material and to carry it through a magnetic cycle.

4. The material has a maximum permeability of twenty-eight to thirty, which is not greatly inferior to that of the values reached for cobalt or a low grade of cast

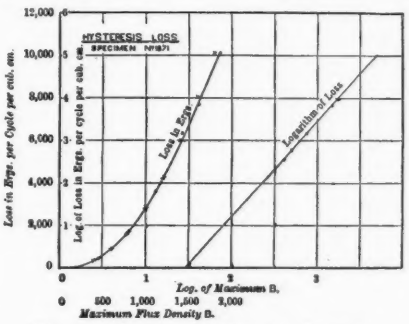

HYSTERESIS LOSS
SPECIMEN N°1871
Loss in Ergs. per Cycle per cub. cm.
Log. of Loss in Ergs. per cycle per cub. cm.
Loss in Ergs
Logarithm of Loss
Log. of Maximum B.
Maximum Flux Density B.

FIG. 3.—HYSTERESIS ENERGY LOSSES.

iron for small magnetic forces, and occupies a position intermediate between the permeability of the ferromagnetic and the merely para-magnetic bodies, such as liquid oxygen and ferric chloride.

5. The material exhibits, therefore, the phenomenon of magnetic retentivity and coercivity. It is not merely magnetic, but can be permanently magnetized.

We are led by these results to conclude that the magnetic properties of this alloy must be based on a certain similarity of molecular structure with the familiar ferromagnetic metals. The hypothesis which best fits the facts of ferromagnetism is that materials such as iron, nickel, and cobalt are composed of molecular groups which are permanently magnetic, and that the process of producing, or changing the evident magnetization of a mass of these metals consists in arranging or disturbing the positions of these molecular magnets. Since, then, we have in this alloy an instance of fairly strong ferromagnetism produced by an admixture of metals possessing in themselves separately no such property, it follows that ferromagnetism *per se* is not a property of the chemical atom, but of certain molecular groupings. The importance of this fact can not be easily overstated. It shows us that in spite of the fact that ferromagnetism has been hitherto regarded as the peculiar characteristic of certain chemical elements—iron, nickel and cobalt—it may, in fact, depend essentially on molecular grouping composed of a comparatively large number of molecules, and, hence, it may be possible to construct alloys which are as magnetic or even more magnetic than iron itself.

[Note added June 2—We have furthermore conducted experiments on the magnetic qualities of the alloy No. 1888/7, and we find them generally to be similar to those of the alloy No. 1871. The alloy No. 1888/7 has less manganese (about five per cent) and more copper (about eight per cent) in it than the alloy No. 1871. In addition, alloy No. 1888/7 contains four per cent of lead. The magnetization curve of the alloy No. 1888/7 was taken with gradually increasing magnetizing forces up to H = 220. The magnetization curve is rather flatter than that of ring No. 1871, and the maximum permeability reaches a value of only fourteen for sample No. 1888/7, instead of nearly twenty-eight. A series of hysteresis loops was taken between the same limits of magnetizing force as in the case of ring No. 1871, and from their areas a curve set out showing the hysteresis loss in ergs per cubic centimetre per cycle (E) in terms of the maximum value of the flux density during the cycle ($B_{max.}$). We found that the relation of these two quantities could be expressed by an exponential function, *viz.*:

$$E = 0.000776\ B_{max.}^{2.288}$$

Hence it appears that for both alloys No. 1871 and No. 1888/7 the hysteretic exponents are not very different, being respectively 2.238 and 2.288, whereas the hysteretic constants are very different, being respectivelv 0.0005495 and 0.000776. It is clear, therefore, that both these alloys, although magnetic, have far greater hysteresis than pure iron, nickel or cobalt, for corresponding cycles of magnetization. We hope to find opportunity of carrying out similar experiments at various temperatures, as the determination of the critical temperature at which these alloys will lose their magnetic susceptibility is evidently a very interesting matter.]

The Calcium Carbide Industry in France.

A recent report from United States Consul Robert P. Skinner, at Marseilles, France, deals with the calcium carbide industry in that country. The principal centres of the calcium carbide industry in France are in the Alps and the Pyrenees, particularly in the environs of Bellgarde, Grenoble, Nice and Tolouse. At present there are eleven manufactories capable of producing 40,000 tons of calcium carbide annually. The total amount sold during the year 1904 was only 18,000 tons. The French manufacturers are protected against importations by the Bullier patent, and the price of carbide is maintained at a little under forty dollars per ton. The standard article is one which will give off 300 litres of gas per kilogramme of the carbide. The retail price is $67.55. The merchandise is packed, according to the wish of the buyer, in metal tins containing 100, 65 or 50 kilogrammes.

INSULATION TESTING—APPARATUS AND METHODS.[1]

BY C. E. SKINNER.

In the design and selection of apparatus for making disruptive tests, a number of points must be taken into consideration. Some of these are: (1) maximum testing voltage; (2) frequency of the testing circuit; (3) static capacity of the apparatus to be tested; (4) variation of the testing voltage; (5) measurement of the testing voltage; (6) provision for locating faults; (7) portability of the testing apparatus; (8) rating of the testing transformers.

For lower voltage apparatus the testing voltage is usually several times the normal rated voltage of the apparatus. For the higher voltages it is rarely more than double the rated voltage. For direct-current street railway work tests of over 5,000 volts are rarely required. For 2,000-volt lighting service, tests of from 4,000 to 10,000 volts are required. Transmission lines require higher voltages and occasionally test voltages of 200,000 are needed. In regard to frequency it may be stated that for a given output the lower the frequency, the larger the transformer required. Also for a given condition of test a larger output testing transformer will be required for high than for low frequencies.

Small samples of insulation require but a small output in the testing transformer, but with large machinery or cables a much larger output is required on account of the current necessary to charge the apparatus or cable, considered as a condenser. Little or no additional transformer capacity is required for ordinary testing beyond that supplying charging current, as shown by the formula $I = 2 \pi \times 10^{-6} \times E \times C \times N$, in which I is current in amperes; E, volts; C, microfarads; N, cycles per second. This is the formula for the flow of current to a condenser when a sine-wave electromotive force is applied to its terminal.

There are three principal methods of varying the testing voltage. By varying the field of the generator, a variation of from fifty per cent of normal rated voltage to a slight amount above the normal voltage. By means of a resistance in series either with the primary or secondary of the testing transformer, connected to a constant-potential source of supply, a cheap method of varying the test voltage is obtained. The third method is variation by steps, and a considerable range of voltage may be obtained by bringing out loops from the high-tension side of the transformer, with further combinations of the low-tension windings. Very close regulation of the testing voltage may be obtained by the use of a second transformer connected direct to the line, and which has a large number of loops in its secondary connected to the primary of the testing transformer through suitable dials.

A still further variation of the voltage may be obtained in most transformers by providing a symmetrical arrangement of the high-tension windings, which may be connected in multiple, multiple-series, or series. Four equal combinations will give three voltages at which the transformer may be used at its full rated capacity, these being twenty-five per cent, fifty per cent and 100 per cent of the maximum rated voltage.

The testing voltage in the lower voltage work may be measured by measuring the primary voltage and multiplying by the ratio of transformation. This method may be inaccurate when the electrostatic capacity of the apparatus under test is large. The voltage may also be measured by voltmeter readings across the high-tension circuit, the readings being taken across the whole or only part of the high-tension windings. Direct-reading voltmeters of the current-operated type used in series with a non-inductive resistance may be employed.

The spark-gap in the high-tension circuit may also be employed, but this method has few advantages and many disadvantages. Special voltmeter windings may be placed on the transformer in such a manner as to give more nearly the actual ratio of transformation than can be obtained by measuring the voltage of the primary circuit. Still another method of measuring the testing voltage is by means of a step-down transformer in the high-tension circuit, connected to a voltmeter. This is a satisfactory method when the voltage is low, but is expensive with high voltages.

When a testing transformer is to be used for routine cable testing, where the tests are applied for some length of time with but short intervals between tests, the rating may properly be made on the time temperature basis. For nearly all other work the rating can be on the basis of the maximum current that the transformer can deliver for short periods of time. It should be apparent that each class of work will require a special rating, and that there will be wide differences between the different classes.

The materials to be tested are so diverse that only general rules as to the methods to be followed can be given.

To insure uniformity of results tests on similar products should of course always be made in the same manner, and it is always desirable to check tests on new materials with results of tests on materials of the same class whose qualities are known, the check tests being made at the same time and under the same conditions.

For sheet material, metal terminals with the edges well rounded to prevent concentration of electrostatic flux at the sharp edges, should be used.

In testing solids the effect of heat due to dielectric losses is an important factor in the results, particularly when large contacts are used and tests are long continued.

Aside from the heating effects the method of applying the voltage when testing samples of material is not of much importance. It is important, for purposes of comparison, that the same method be used for different samples of material of the same general class. As the actual breaking-down point is desired in most tests on material, the voltage must be applied in predetermined steps, or the rate of increase must be such that voltmeter readings can be taken and the exact point of breakdown determined. For low-voltage tests the step-by-step method, keeping the primary voltage constant and determining the test voltage by ratio, is recommended for rapid work. For higher voltages, say above 20,000 or 25,000, the slow increase of voltage, either by steps without opening the circuit or by smooth increments. No single test should be taken as an index of the dielectric strength of any material, but the average and lowest of many tests should be considered.

In the testing of dynamos, motors, transformers, cables, etc., the static capacity of the apparatus under test becomes of more importance, especially with the higher-voltage tests, requiring larger testing apparatus and greater care in the application of the testing voltage.

Tests on finished apparatus are usually not made to determine the ultimate breaking-down strength, but to determine whether or not the insulation as a whole will stand a certain predetermined test, allowing a factor of safety over the working voltage. It is good practice in manufacturing work to test each part as it is finished, as well as the completed apparatus, in order that any defective workmanship or material may be discovered before the parts are finally assembled.

Transformers are sometimes tested by their own voltage, this giving a plan different from any of those described above and requiring no testing transformer. In such tests, one side of the high-tension winding is connected to the low-tension and the iron, and then the transformer operated at a potential sufficiently above the normal to give the necessary test voltage. The other side of the high-tension winding is then connected in the same way, and the test repeated. Attention should be called to the fact that in this test the middle part of the winding receives but half the total test voltage to ground and low-tension coils, there being a uniform grading of test voltage along the winding from the middle point to the outer ends.

[1] Abstract of paper read before the National Electric Light Association, Denver, Col., June 7, 1905.

The Lewis and Clark Exposition.

(By Our Special Correspondent.)

THE Lewis and Clark Exposition at Portland, Ore., commemorating the hundreth anniversary of the discovery and exploration by Lewis and Clark of the Oregon country, is ideally situated for an exposition and for the accompanying electrical effects. Both have been utilized to the fullest extent. On the gradually sloping ground, rising from a natural lake, are the exhibition palaces, the whole lying against a background of mountains covered by virgin forest. The contour of the ground has not been changed.

Near the Washington and California buildings the original forest trees have been utilized for a park, adding greatly to the landscape effect. The grounds are compact and have allowed an electrical treatment scarcely possible under other circumstances.

Frosted lamps are used exclusively for illumination and decoration and give a soft mellow light. For outlining the buildings and such work the ordinary type of incandescent lamp is used. The equipment consists of 100,000 four to twenty-four-candle-power lamps. For the walks and promenades about 5,000 Meridian lamps of fifty candle-power are used. A special fixture carrying from six to twenty-seven lamps has been devised for them. The color of the earth adds greatly to the diffusion and the grounds appear very well lighted.

In Centennial Park, around the Washington building, a very pretty effect has been got by hanging the lamps in the trees among the leaves. At a distance it gives the effect of a gigantic Christmas tree, 5,000 lamps and twenty miles of rubber-covered wire were used, but not a single insulator. Because of objections to damaging the trees this experiment was tried, with entire success. The wire is run underground to the trees, up the trunks through iron pipes and then distributed.

There is no steam generated within the grounds, it having been found that the Portland General Electric Company would furnish power cheaper than it could be generated by the exposition management. Though this company has water power, it has installed two 1,500-kilowatt steam turbines to carry the fair load. In addition it furnishes 500 horse-power in direct current for pumping. To keep the water pure, the lake is being maintained above the level of the Wilamette river by a dam, and 25,000,000 gallons of water are pumped into it daily.

After a careful consideration of the con-

SUNKEN GARDENS AND AGRICULTURAL GARDENS, LEWIS AND CLARK CENTENNIAL EXPOSITION, PORTLAND, ORE. SHOWING DETAIL OF ELECTRIC LIGHTING FIXTURE.

ditions, a two-wire system of distribution, which greatly reduced the copper investment, was decided upon. Within the grounds are two miles of 220-volt and ten of 110-volt conductors, all underground. These are carried in simple wooden boxes, the former of one by twelve-inch lumber, the latter of one by eight-inch, fastened by glass and porcelain insulators. Despite the heavy rains the drainage is so good that no trouble has been experienced.

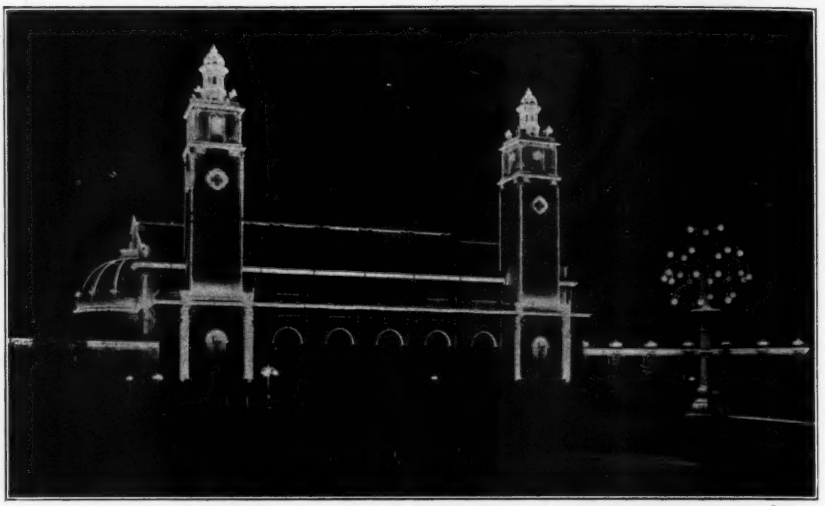
In the submarine illumination in the lake an interesting point was noted. The frosted lamps took up so much water in a few days as to completely ruin them. A lamp is now being sought which will remove this difficulty.

In the government display, which is of a very high standard, are included types of the electrical equipment of the army and navy, both ordinary and wireless. It is a very well arranged exhibit. The Electricity, Machinery and Transportation building, though somewhat away from the line of travel, gets its quota of visitors. This western country is virtually the parent of long-distance transmission lines and much interest is displayed. There is scarcely a farm that has not a little water power.

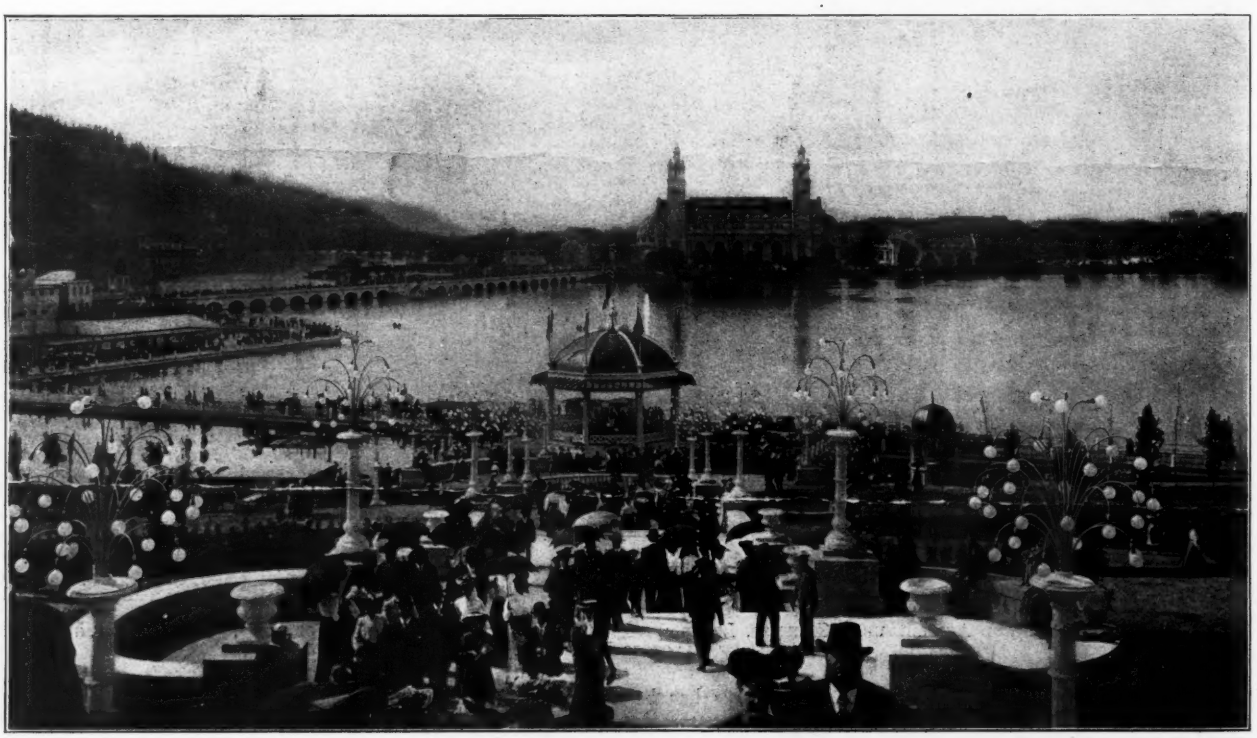
As exhibitors the American electrical manufacturers are represented as follows: the General Electric Company, the Westinghouse Electric and Manufacturing Company, the Western Electric Company, John A. Roebling's Sons Company, the Northern Electrical Manufacturing Company, the Holtzer-Cabot Electric Company, the Pacific Steel and Wire Company and the Standard Underground Cable Company.

G. W. K. HARTMAN.

Portland, Ore., July 15.



THE GOVERNMENT BUILDING AT NIGHT, LEWIS AND CLARK CENTENNIAL EXPOSITION, PORTLAND, ORE.



THE GRAND STAIRWAY, LEWIS AND CLARK CENTENNIAL EXPOSITION, PORTLAND, ORE. SHOWING THE FORM OF ELECTRIC FIXTURE USED.

The Use of Electricity in Celebrating the Fourth.

When John Adams wrote to his compatible spouse, Abigail, on the evening of July 4, 1776, announcing the adoption of the Declaration of Independence, and in his patriotic frenzy foretelling that the day would be celebrated in years to come with all manners of fire and noise, which have since struck deeper grounded terror to the insurance fraternity than it did at the time to the mother country, he did not dream in his presage that electricity, which his colleague, Dr. Franklin, had brought to the fore twenty-five years agone, would have a part in these celebrations.

Electricity has from time to time added to the new methods for the national holiday.

A part of the celebration at Boston, July 4, 1863, consisted of three arc lights,

one on the dome of the State House, another on the corner of the Park and Beacon street, and the third on the hill on the southerly part of the Common, which is now the site of the Soldiers' Monument.

These arc lights were sustained by large batteries of many cells and the expense of $1,500 for what was described in a contemporaneous account as "wonderful beyond description" appears to be excessive in the light of what is accomplished at the present time.

NIGHT VIEW OF GROUNDS, SHOWING REFLECTION IN THE LAGOON, LEWIS AND CLARK CENTENNIAL EXPOSITION, PORTLAND, ORE.

CENTENNIAL PARK, LEWIS AND CLARK CENTENNIAL EXPOSITION, PORTLAND, ORE. ELECTRIC LIGHTS WERE STRUNG THROUGHOUT THESE TREES, MAKING UP A SPECTACULAR NIGHT PICTURE.

The telegraph was used at an early day to supervise the great civic processions which are used in some parts of the country on these celebrations, but it has been superseded by the telephone of late years.

The first instance of operating a procession by telephone was that of the Columbian procession at New York in October, 1892, when Thomas Byrnes, the superintendent of police, had a large number of telephone booths built along the line of march and from his office directed every movement, including several cases of engineering which required prompt action.

Since that time the equipment of police record stations with telephones enables the supervision of a procession over almost any usual route in a city without the installation of special apparatus.

New England boys in many places celebrate "the night before" in a sonorous manner, more in touch with their own exuberance than that of their elders who forget that they were once boys.

In some towns pandemonium is let loose as soon after sundown as gunpowder shows the flash, and in other towns they must restrain themselves until midnight or even 4 A. M., when a stroke of the fire alarm announces that the lid is off.

The band concerts and fireworks celebrations are helped by the usual festoons of incandescent lamps, which are shut off when the set pieces are fired, and in this manner electricity adds to the comfort

of the occasion by restraining the tendency to disorder which would otherwise occur during the intermittent darkness.

On one Fourth of July P. S. Gilmore, the great bandmaster, had an enormous massed band, in which the bass drum parts were played by a number of cannons which were fired by electricity.

As the park of artillery was necessarily a short distance at the rear of the band, they were fired a little in advance of the bass drum beats, and this duty, requiring a thorough performer, was entrusted to no less a musician than Dr. Eben Tourgee, the director of the New England Conservatory of Music.

That beacon fires should blaze from hill to hill is but the action of traits of prehistoric heritage, but it has remained until 1905 for such a beacon fire to be set by electricity.

On Lookout Hill in Salem, which is one of the highest points of land in the county, a pile of hogsheads, railroad sleepers, and other combustibles fifty feet square and eighty feet high was erected for the occasion.

At midnight the mayor of Salem struck the fire alarm for the celebration to begin, and in the presence of a concourse of 30,000 people the top of this immense pile was ignited from a distance of about 600 feet by space telegraphy.

The apparatus was made and operated by John J. Brophy, a young man only eighteen years old, who is employed in the electrical business.

A few years ago the city government of Lynn, Mass., considered the proposition of one prominently connected with the General Electric Works in that city to give an electrical fireworks celebration, in which it was promised that the lights would be more dazzling and the explosions more deafening than those of any other methods hitherto used, but other counsels prevailed, and the usual fireworks of Chinese origin were given, and it may remain for us to chronicle such an electrical celebration a year to come.

BOOK REVIEW.

"The Copper Handbook." Vol. v, 1905. Houghton, Mich. Horace J. Stevens 882 pages. 6½ by 9 inches. Supplied by the ELECTRICAL REVIEW at $5 in buckrum binding with gilt top, and at $7.50 in full library morocco and full gilt.

This is the fifth annual edition of "The Copper Handbook." The volume is divided into sixteen chapters devoted to the history, uses, terminology, geology, geography, chemistry, mineralogy, finances and statistics of copper. The larger portion of the book is devoted to the chapter containing a detailed description of the copper mines of the world—3,489 in number. These descriptions range from two lines to twelve pages, according to the importance of the property. Originally the book was a strictly local publication, the first issue being devoted exclusively to Lake Superior mines. In five years it has become a standard reference book, and is used in every country on the globe that produces copper.

THE CONVENTION OF THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES, AND THE ELECTRICAL EXHIBITION.

BOSTON, MASS., JULY 15-22.

As announced in the last issue of the ELECTRICAL REVIEW, the annual convention of the National Electrical Contractors' Association of the United States was opened by a formal meeting of the national directors on Tuesday, July 18. On Wednesday, July 19, an open session was held. On Thursday and Friday executive sessions of the National association were held, the election of officers taking place on the morning of Friday, July 21. The following officers were elected for the ensuing year:

HEADQUARTERS OF G. M. GEST AT THE ELECTRICAL EXHIBITION IN MECHANICS' HALL, BOSTON, MASS, JULY 15-22, 1905.

President—James R. Strong, New York city.

First vice-president—W. I. Gray, Minneapolis, Minn.

Second vice-president—W. C. McIntire, Philadelphia, Pa.

Third vice-president—F. E. Newbery, St. Louis, Mo.

Treasurer—John R. Galloway, Washington, D. C.

Secretary—W. H. Morton, Utica, N. Y.

Sergeant-at-arms—J. C. Stearns, Buffalo, N. Y.

DIRECTORS.

For Arkansas—T. B. Martin, Little Rock.

Connecticut—E. M. Baldwin, Hartford.

District of Columbia—Cyrus Mantz, Washington.

Illinois—Arthur Frantzen, Chicago.

Indiana—G. M. Sanborn, Indianapolis.

Iowa—Edward Kunkle, Des Moines.

Maryland—P. K. McCay, Baltimore.

Massachusetts—S. B. Wetherbee, Boston.

Michigan—F. J. Mines, Detroit.

Minnesota—S. S. Sanford, Minneapolis.

Missouri—W. A. Curran, St. Louis.

New Jersey—Paul H. Jaeling, Newark.

New York—James R. Strong, New York city; M. C. Barnes, Troy, and James Hilton, Syracuse.

Ohio—E. M. Lawton, Cincinnati.

Pennsylvania—E. R. Keller, Philadelphia.

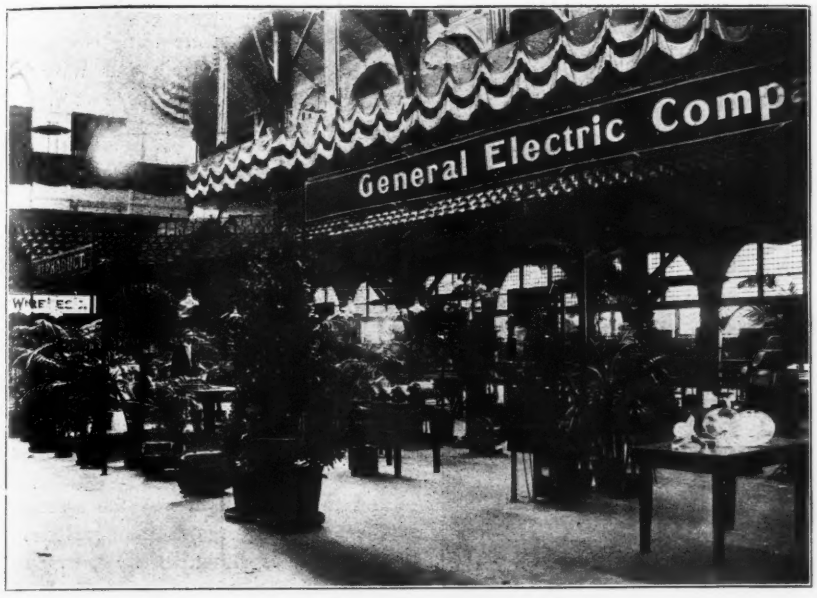
Wisconsin—George W. Rohan, Milwaukee.

The entertainment included the annual dinner at the Hotel Brunswick on Wednesday evening. On Wednesday morning the ladies were conducted on an all-day trolley trip, visiting Brookline, Auburndale, Waltham, Lexington, Bedford and Concord. On Thursday the members and guests, including the ladies, made a trip to Nantasket Point Hotel, where a shore dinner was served. On Friday trolley trips were made in and about Boston, visiting Bunker Hill, the navy yard, Charlestown, Somerville, Powder House Hill, Arlington, Arlington Heights, Mount Auburn, Watertown, Cambridge and Harvard University.

A very complete summary was given last week of the exhibitors and representatives at the electrical exhibition, which was held in Mechanics' Hall, July 15-22.

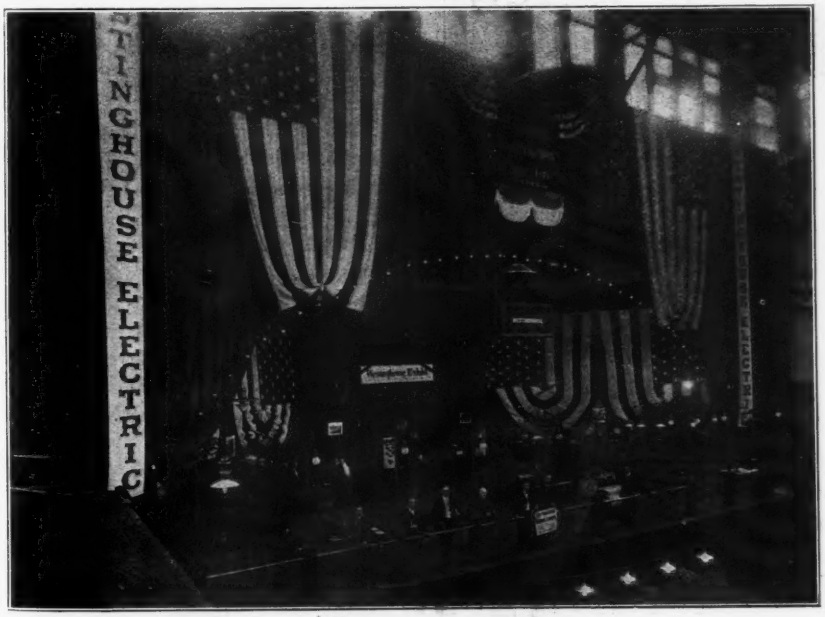
The accompanying illustrations will display some of the features of the decorations and exhibits.

The Trumbull Electric Manufacturing Company, Plainville, Ct., exhibited a complete line of switches, cutouts, rosettes, combination switches, weatherproof sockets, porcelain-base switches, flush receptacles, cord adjusters, pendant switches, switchboards, panel-boards, iron service boxes, fuse blocks and panel cutouts. This exhibit afforded the Trumbull company an excellent opportunity for displaying its goods to advantage. The material shown attracted a great deal of attention, and this opportunity has undoubtedly been instrumental in acquainting the contractors and the public at large with the facilities of the Trumbull company for turning out this material.



HEADQUARTERS OF THE GENERAL ELECTRIC COMPANY AT THE ELECTRICAL EXHIBITION, MECHANICS' HALL, BOSTON, MASS., JULY 15–22, 1905.

The Thompson-Bonney Company, Incorporated, New York city, had on exhibition an electrical revolving display and metallic showcase. This showcase may be equipped with four or six trays, eight or ten inches wide; eight or twelve miniature lamps; a one-ninth-inch variegated colored cylinder extending the full length of the case, containing one sixteen-candle-power lamp to one running foot. When the current is on the trays, with their contents, the miniature lamps and the illuminated colored cylinder all move noiselessly, effecting a brilliant display of the goods and a changeable illuminated sign. The wording on the sign may be changed as often as desired.



HEADQUARTERS OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY AT THE ELECTRICAL EXHIBITION, MECHANICS' HALL, BOSTON, MASS, JULY 15–22, 1905.

The Valentine Electric Sign Company, Atlantic City, N. J., exhibited a remarkable display of electric signs. The company manufactures a stock letter suitable for mounting in any kind of a frame or bracket. It enables the dealer to buy the manufactured parts and assemble them the same as a cluster. The parts are made entirely of iron, even to the moulding and trim. The electric signs of this company are fitted exclusively with "Munder" lamps. The company was represented by Mr. C. F. Munder, president, and Thomas E. Valentine, vice-president and general manager.

The exhibit of G. M. Gest, New York and Cincinnati, was presided over by Mr. W. T. Jackson. As the illustration herewith shows, the principal feature of the display was a large sign calling attention to the company's offices and the work it performs. A handsome series of photographs showing typical construction work going on in the various parts of the country was displayed, and these photographs attracted considerable attention.

Mr. R. A. Schoenberg, proprietor of the Sarco Company, New York city, distributed as a souvenir a notebook in the shape of a new pendant switch. This is a new six-ampere, 125-volt, quick-break switch, and was on exhibition connected to a regular arc lamp. In addition to the new switch there were a number of other "Sarco" specialties, including the well-known "Noscru" specialties and the "Midget" push switch.

The display of the General Electric Company, Schenectady, N. Y., was luxuriant with palms and potted plants. A feature of this exhibit was the new two and one-half-watt incandescent lamp. The company's exhibit was brilliantly illuminated at all times with these lamps, and as this was the first exhibition to the general public where the new metallized filament has been shown, a good deal of interest was demonstrated. These lamps were shown in three sizes—No. 3, No. 4 and No. 5, the watt consumption being 125, 187.5 and 250 watts per lamp, respectively. The lamps are used with a special line of Holophane pagoda reflectors, which are made in two forms, one distributing light in a downward direction, and the other concentrating it more to the vertical. The actual efficiency is

stated by the company to be twenty per cent greater than the best obtained from the highest efficiency incandescent lamps of the past, on an equal basis of life. The mercury-arc rectifier is also clearly shown in the illustration. This was turned on a 220-volt, single-phase circuit, delivering 110 volts direct-current, the load being a circuit of the new incandescent lamps. This rectifier had a capacity of thirty amperes, and was shown in regular operation. A collection of small motors of various types was shown, including the new automobile motor, and a miscellaneous collection of standard electric motor fans. In the electric cooking line the new flat-iron was shown. An interesting feature of this exhibit was the mutoscope whir of a direct-driven cotton loom. This cotton loom was driven by an induction motor without the interposition of a friction clutch. This form of drive is a departure, and is said to be giving great satisfaction. In addition to these features there was a fine display of three-glower Nernst lamps. The frosted globes were exhibited with a reflector, and the opal globes, which were a little larger in size, were exhibited without the reflector. This form of Nernst lamp is meeting with great popularity for various phases of illumination. A conspicuous part of the display was an archway of incandescent lamps. Suspended beneath this were Cooper Hewitt mercury vapor lamps of various capacities. A fine line of arc

HEADQUARTERS OF THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, AT THE ELECTRICAL EXHIBITION, MECHANICS' HALL, BOSTON, MASS., JULY 15–22, 1905.

pictures showing races between the General Electric locomotive and a standard steam-drawn train on the New York Central lines. Views of the workmen leaving the General Electric works were also shown, and moving pictures were displayed of the Baltimore & Ohio electric locomotive and the New York subway trains. These trains are operated by General Electric motors with multiple unit control.

The Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., occupied all of the grand platform of the exhibition hall. A spectacular feature of this display was the static sign, which showed myriads of streamers darting out from the letters which spell the name of Westinghouse. Along with the crackle and roar of this high-tension sign was the lamps was shown, and a very complete display of measuring instruments, together with various apparatus, such as transformers, small motors, etc., made up a very pleasing representation of Westinghouse products.

The Benjamin Electric Manufacturing Company, New York city, made an elaborate display of clusters, the brass work and unfinished parts of this apparatus exciting a great deal of favorable comment. The Benjamin "Arc-Burst" was displayed to advantage. The clusters were shown in many styles, both with and without reflectors.

A number of the manufacturers distributed souvenirs, several of which were of a distinctly practicable nature. The souvenir from G. M. Gest was a horn-handled, two-blade pocket knife. The De Veau Telephone Manufacturing Company distributed a celluloid foot-rule in a leather carrying-case. The Diehl Manufacturing Company distributed a matchless match safe. The Jamaica Plain Electric Company distributed a souvenir in the form of a cast-iron mould after the type of a Gleason moulding box, and the Eastern Electric Cable and Wire Company distributed a unique desk clock.

Organization of Indiana Telephone Association.

On July 12 a meeting of telephone men representing the independent telephone interests of Indiana was held at Winona, Ind. About seventy-five telephone men were present, representing probably about 40,000 telephones. The call was made by Theodore F. Thorward, president of the Indiana Mutual Telephone Association.

A constitution and by-laws was prepared by the committee on organization, and this was adopted by the association. The plan of organization includes the formation of eleven districts, which will be represented in state meetings by delegates. Each district will have a president, who will be a vice-president in the state organization. State officers were elected as follows:

George W. Beers, Fort Wayne, president.

Charles S. Norton, Indianapolis, secretary and treasurer.

Vice-presidents were elected for the eleven districts as follows:

First district—Theodore F. Thorward, South Bend.

Second district—W. L. Moellering, Fort Wayne.

Third district—Walter J. Uhl, Logansport.

Fourth district—Oliver P. Freiburg, Lafayette.

Fifth district—Thomas A. Bromley, Jr., Muncie.

Sixth district—Charles F. Duffin, Terra Haute.

Seventh district—W. W. Mendenhall, Indianapolis.

Eighth district—A. C. Lindenmuth, Richmond.

Ninth district—W. C. Curil, Petersburg.

Tenth district—C. D. Knoefel, New Albany.

Eleventh district—W. R. Swarthout, Rising Sun.

The meeting was addressed by J. B. Hoge, Cleveland, Ohio, president of the National-Interstate Telephone Association.

Notes on Iron Loss.

An experimental research has been made by Mr. F. Lydall to determine whether the Steinmetz law for hysteresis loss holds good with densities as high as 20,000 lines per cubic centimetre. As a large magnetizing force was required, it was essential that the iron loss should be measured directly, and not estimated as the difference between the total loss and the loss due to the resistance of the magnetizing coils. The samples of iron tested were stamped rings built up so as to form a fairly thick ring, and on this were wound four coils. Under these four windings there was a layer of fine wire distributed uniformly around the ring. The direct measurement of the iron loss was obtained by means of a wattmeter, one coil of which was connected to the fine wire on the ring, while the other was connected in series with the magnetizing coil. The watts measured by the wattmeter were therefore dependent on the back electromotive force in the windings, and not on the applied electromotive force. Readings of the average value of the back electromotive force were obtained by means of a direct-current voltmeter and a commutator. The results of the tests plotted show a loss curve which deviates from that calculated according to Steinmetz's law, with inductions above 18,000 the observed values being higher than those calculated. The difference may be accounted for by assuming that the hysteresis loss increases more rapidly than the 1.6 power of the induction, or that the induction curve is distorted, or that leakage takes place which sets up eddy currents, this being possible due to the character of the magnetizing winding. In the writer's opinion the solution of the problem is to be found by examining the curves for a number of generators. These curves do not follow, throughout their range, either the law of the 1.6 power or the law of the square. The shape of the curve changes gradually from approximately the square to higher powers. This change invariably takes place when the saturation curve begins to bend over. The higher up on the saturation curve, the greater is the slope of the iron loss curve, or the higher the power of its variation. From these considerations it is safe to assume for practical purposes, that the hysteresis loss varies as the 1.6 power of the induction, even up to the highest values, and therefore the additional loss must be due to unaccounted-for eddy currents. Analyzing the iron loss in the teeth, it is found that there is a considerable loss, in addition to the hysteresis and normal eddy currents in the plates themselves, and this additional loss follows, to a certain extent, the saturation curve, and depends partly upon the saturation of the teeth. This loss must take place at the surface of the iron, and it is suggested that the greater part of it is due to leakage lines which begin to pass from the pole-face to the cast-iron end-plate of the armature when the teeth become saturated. The loss is therefore proportional to the square of the frequency and to the square of the magnetizing ampere-turns. The author has analyzed a good many curves, and has found that this explanation holds good in many cases. This suggests that this explanation might be easily tested by taking comparative curves on the same armature with different air-gaps, or by fitting the magnetic shields over the end-plates so as to cover, as nearly as possible, the ends of the armature, these end-plates remaining stationary while the armature revolves. — *Electrical Review (London), June 23 and July 7.*

The American Railway Mechanical and Electrical Association.

The annual convention of the American Railway Mechanical and Electrical Association will be held in Philadelphia, Pa., September 25 and 26. Standing committees have been appointed to consider the following subjects:

"Controlling Apparatus," J. S. Doyle, master mechanic, Interborough Rapid Transit Company, chairman. This report will consist of two papers, one entitled "Multiple Unit Systems of Train Control," by Hugh Hazleton, and one on "Street Car Controllers," by W. A. Pearson.

"Way Matters," F. G. Simmons, superintendent of construction and maintenance of way, Milwaukee Electric Railway and Light Company, chairman. Mr. Simmons will read a paper entitled "Cast Welding," and will give a summary of the entire report of the committee. The other papers are "Thermit Railway Welding," by George E. Pellissier; "Zinc Welding," by H. B. Nichols and C. B. Voynow, and "Electrical Welding."

"Brakes," A. F. Carver, chief engineer, Public Service Corporation of New Jersey, chairman. This report will include a paper entitled "The Track Brake," by F. F. Bodler.

"Maintenance and Inspection of Electrical Equipments," William Pestell, chairman. This report will include data prepared by Mr. Pestell and Mr. H. E. Farrington.

"Power Stations," Fred Bushnell, chief engineer of the Rhode Island Company, Providence, R. I., chairman. This report will also include a paper on "Power Distribution," by C. H. Hile, superintendent of wires, Boston Elevated Railway Company; and a paper on "The Power Station Load-Factor as a Factor in the Cost of Operation," by L. P. Crecilius.

The Leitner-Lucas Train-Lighting Dynamo.

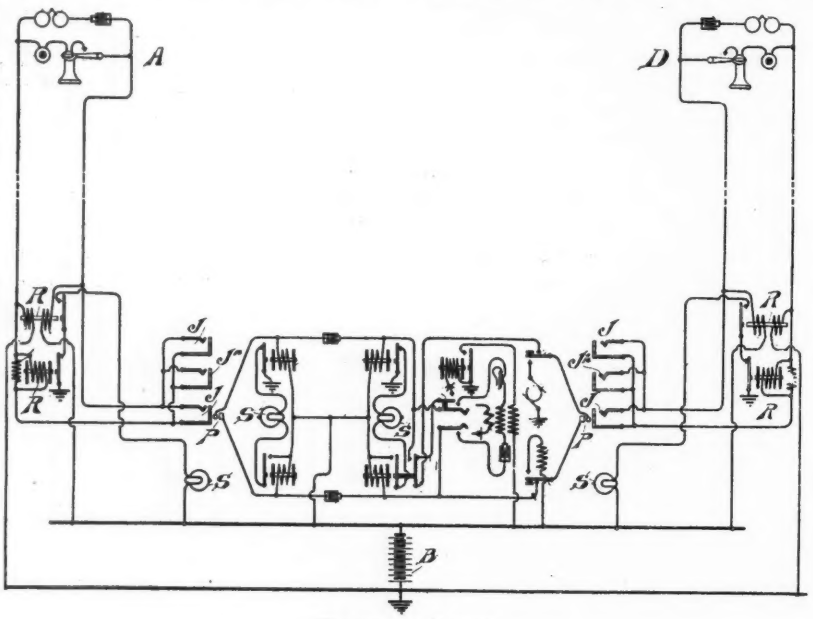
An improvement has been made recently in the Leitner-Lucas train-lighting system, consisting in an alteration of the dynamo so as to make it completely self-controlling, and doing away with the demagnetizing exciter used previously. In the system as it is now employed on a number of European roads, the voltage of the generator is kept constant, independent of speed, by means of a small exciter mounted on the dynamo shaft, which supplies current to a set of demagnetizing coils on the main dynamo field. In the newer design this demagnetization is brought about by adding a second pair of brushes to the main dynamo. These are placed at right angles to the main dynamo brushes. Each of these auxiliary brushes is taken with one of the main brushes to form a pair from which current is supplied to the demagnetizing coils. Obviously the greater the speed of the dynamo, the greater will this demagnetizing current be; and the characteristics of the machine, as shown, give a practically constant voltage with a variation in speed from 500 to 2,100 revolutions per minute. When the direction of rotation is reversed it is necessary not only to shift the position of all the brushes, but to change the field connections. On the new dynamo, which is a four-pole machine, there are four main brushes and two auxiliary brushes.—*Electrician (London), July 7.*

American Engineers in London.

The J. G. White Company interests, of New York and London, are creating a considerable stir in London building circles. The office building for the International Navigation Company and the new Ritz Hotel are being constructed along the most advanced American engineering and contracting lines. The satisfaction of London owners with this phase of the American invasion is attested by the increasing amount of business which these companies are receiving. The latest contract is for the construction of an apartment house adjoining the French Embassy, on Knight's Bridge, London, W. C., facing Hyde Park. The apartment house, when completed, will be one of the finest in the city of London.

Electrical Patents.

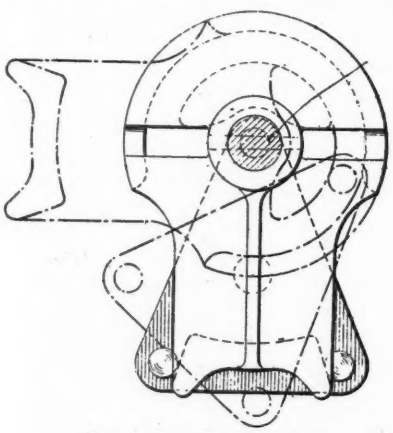
An improvement in telephone systems is the subject matter of a patent granted to William W. Dean, of Chicago, Ill., who has assigned his entire interest in the patent to the Kellogg Switchboard and Supply Company, of the same place (No. 794,348, dated July 11, 1905). The invention



TELEPHONE SYSTEM.

relates to improvements in telephone systems, and more particularly in the type known as "two-wire" telephone systems. The invention includes a line-circuit which avoids certain defects. For instance, there need be no relay contacts in the talking-circuit of the line, the cutoff relay may be very simple in construction, since only an ordinary relay with one contact is required, and the line is clickless, since the cutoff relays do not sever the normal battery connection and the potential remains practically constant on the line during the operation of establishing connections with calling lines. A telephone line is employed with connections therefor. A line-signal controlling magnet and a common source of current are connected with the line at the central office. Operator's connective means are provided at the central office to establish connections with the lines of the system for conversational purposes through the medium of the connection terminals, the connection terminals being conductively associated with the line during such connections. Means are provided under the control of the subscriber to permit a flow of current over the line from the source to operate the magnet and thereby the line signal. A cutoff magnet for the line is in series between the line-signal controlling magnet and the connection terminals, and is adapted to be operated when a connection is established with the line by the connective means to render the line signal inoperative.

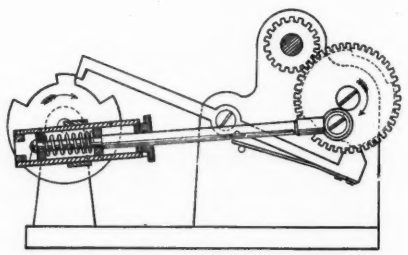
The Westinghouse Electric and Manufacturing Company controls a patent granted to Ray P. Jackson, of Wilkinsburg, Pa., on an electrical controller (No. 794,358, dated July 11, 1905). The invention has for its object to provide a connecting device between the main and reversing drums of a controller by means of which the reversing drum is actuated by the operation of the main drum and is prevented from



ELECTRICAL CONTROLLER.

independent operation. It has frequently occurred in the use of controllers in which the movement of the main drum serves to operate the reversing drum and in which no provision is made for locking the reversing drum in position, that the reversing drum has been moved accidentally by reason of vibration or other causes. Such accident, besides being the cause of an interruption in the service of the apparatus governed by the controller, is also likely to result in injury to the controller or to the distributing system, and it is the primary object of the invention to avoid these objections. In carrying out the invention a main drum and a reversing drum are employed, also means for actuating the reversing drum when moving the main drum and for preventing independent operation of the reversing drum, this means comprising a plate mounted on the end of the main drum shaft having an approximately semi-annular groove and a projection. A plate is mounted on the end of the reversing drum shaft and is provided with spaced pins, one of which projects into the groove of the plate when the controller is in its running position and the other two of which engage respectively with the projection when the controller is in its "off" position.

Hubert Pfirmann, of Frankfort-on-the-Main, Germany, has patented in this country an electrical switch, such as is used for sending current impulses into an electric circuit (792,845, June 20, 1905). The present invention may be used in connection with a safety device

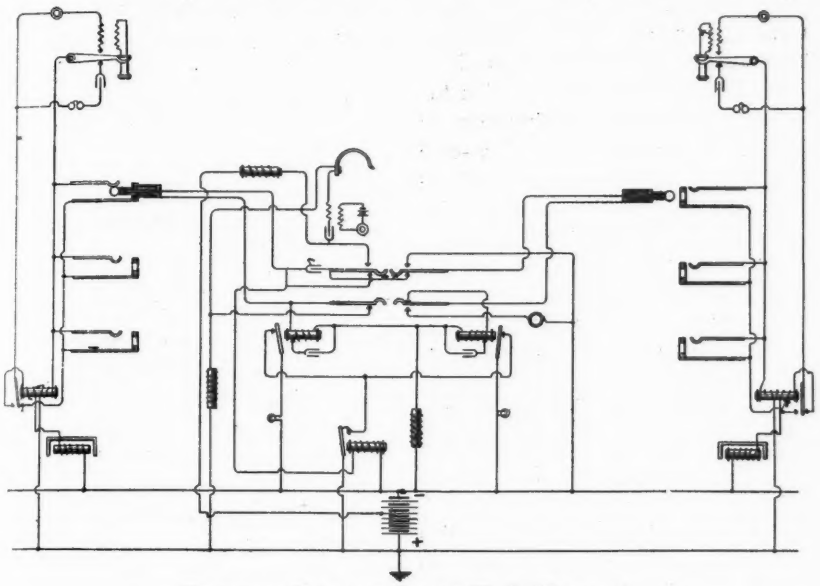


ELECTRICAL SWITCH.

for railways invented by Mr. Pfirmann, and numbered 742,487, dated October 27, 1903. In using the present invention as a means for operating such safety device on railway rolling stock, a source of electric current is carried by the rolling stock. A movable current-reversing switch is connected with the source of current and is adapted to alternately connect the poles of the source of current with a track conductor. A device is employed for driving the switch by the movement of the rolling stock, also means for temporarily detaining the switch in an active position. An elastic device is arranged to be put under tension by the driving mechanism while the switch is detained. Means are also provided for throwing the detaining device out of action and allowing the elastic device to throw the switch beyond its inactive position, this means being opera-

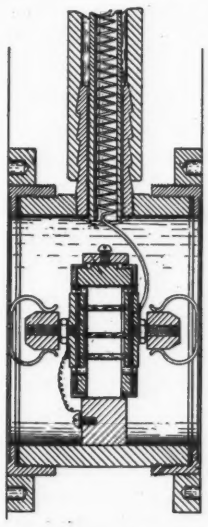
tively connected with the driving mechanism.

A telephone exchange system has been invented by Harry G. Webster, of Chicago, Ill., and has been assigned to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. (793,971, July 4, 1905). The invention relates particularly to the so-called "test-circuit" for use in connection with multiple exchange switchboards. The invention is particularly well adapted for use in connection with telephone systems in which a source of current located at the central exchange is used for the purpose of supplying callers and signaling currents to the subscriber's substation apparatus. In the embodiment of the invention, a telephone line extends by its limbs from a substation to an exchange. A common battery is located at the exchange for supplying talking and signaling currents to the line, cord-connecting apparatus being also located at the exchange for connecting the line with another for conversation. A test thimble is normally disconnected from the battery. Means are provided whereby the connection of the cord-connecting apparatus with the line having a conductively completed circuit through a substation transmitter causes the test thimble to be connected with the battery and charged to a potential intermediate between the potentials of the terminals of the common battery. A test-contact forms the tip contact of the calling plug associated with the cord-connecting apparatus connected through an impedance coil to an intermediate element in the common battery such that the test contact will be charged to a potential only slightly different from the potential of the test thimble of a busy line. An operator's telephone set is inductively associated with the test circuit, whereby a click is produced in the operator's receiver upon the application of the charged test-contact to the test thimble of a busy line.



TELEPHONE EXCHANGE SYSTEM (H. G. WEBSTER.)

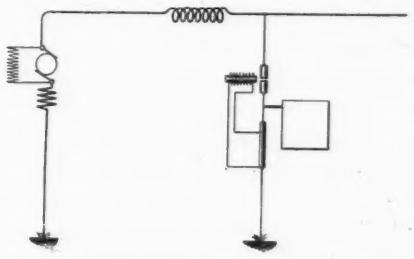
Arthur J. Mundy, of Boston, Mass., is the inventor of a submarine signal which he has assigned to the Submarine Signal Company, of Waterville, Me., and of Boston, Mass. (793,996, July 4, 1905).



SUBMARINE SIGNAL.

The invention relates to that portion of a submarine signaling system which includes the means for taking the sound-signals conducted by the water from a submerged signaling apparatus from the water and transmitting them, preferably electrically, to a telephone receiver on a vessel. This portion of the apparatus, as a whole, is named a "hydrophone." The part of the hydrophone which is immersed in the water and receives sound impulses from it and transmits them is termed the "hydrophone-transmitter," or for short the "transmitter." The part which receives the impulses from the transmitter and delivers the sound to the hearer is called the "hydrophone-receiver" or the "receiver." For use on vessels carrying machinery making noise, as, for instance, steamships, the inventor has discovered that it is desirable to take and transmit the sound signals conducted from the water by the water at a point away from the vessel and below the surface of the water and also while the vessel is in motion. The present hydrophone comprises a device the sound-transmitting portion of which is adapted to be let into the water from the stern of a moving vessel at any desired distance therefrom and at any required depth below the surface of the water, and the receiver portion of which is adapted to be carried on the vessel and to receive from the submerged sound-transmitter and the sound signals conducted to it by the water and deliver them audibly to the hearer on the vessel. It is preferable to employ as a means for holding the hydrophone-transmitter submerged a transmitter holder, which has a shape resembling that of a fish, which holder is provided with means whereby while being towed, it is caused to assume an upright position below the surface of the water and to maintain such position so long as it may be towed or in motion.

Thomas J. Johnston, Brooklyn, N. Y., has assigned to the General Electric Company, of New York, a patent granted to him on a lightning arrester (793,445, June 27, 1905). The invention has for its object to improve the protection which these devices afford to electrical machinery generating current at such potential as is liable to cause an arc to follow the action of the lightning arrester when it relieves the line of static charge. The invention comprises a plurality of spark-gap terminals, a direct connection between one of the terminals and the circuit to be protected, a ground connection from another of the terminals, a non-inductive resistance in the ground connection, and a device possessing electrostatic capacity associated with the spark-gap terminals.



LIGHTNING ARRESTER.

Reviews of Current Engineering and Scientific Literature.

A New Form of Electrolytic Interrupter.

The Wehnelt interrupter, while so convenient for exciting induction coils, has several faults: its efficiency is low, being frequently less than twenty per cent, and for this reason the liquid heats rapidly until it ceases to act. To overcome these troubles inventors have cooled the liquid either by means of a cooling coil through which cold water flows, or by supplying a large volume of the liquid and causing this to circulate in its containing-jar. If the temperature can be kept down, and the interrupter made to work satisfactorily for a considerable time, the low efficiency is not of much importance. A recent ingenious arrangement to effect this purpose was exhibited a short time ago to the Physical Society, Paris, by J. Carpentier, of that city, and is here described by M. H. Armagnat. The liquid of the interrupter, which may be one of a number of solutions, was placed in a fairly large jar, so as to afford an ample supply. Into this liquid a lead tube, which forms one electrode, is inserted, reaching nearly to the bottom of the jar. The upper part of this tube is perforated both above and below the surface of the liquid, so as to allow any vapor to escape, and also to permit free movement of the liquid. The other electrode, which is a platinum wire mounted on an adjustable rod, is placed within the lead tube, projecting below the openings in the latter. When the device is in operation, the heat given off heats the liquid within the lead tube and causes a current to circulate, which keeps up a constant supply of fresh, cool electrolyte. The most satisfactory salt to use is one-tenth saturated solution of sulphate of magnesium, since this gives a good action and does not set free disagreeable gases.—*Translated and abstracted from La Revue Électrique (Paris), June 30.*

The Starting of Induction Motors.

A new method of starting induction motors is described here by Mr. Frank Lewis, who has constructed a machine according to his designs. The author first takes up the various methods which are employed for increasing the starting torque of this type of motor, calling particular attention to the method which he calls selective winding. The first machine of this type was designed by Bradley, and consisted of two entirely separate squirrel-cage rotors, of the same length, on one shaft, one of high and one of low resistance; and a single stator, which could be made to traverse so as to embrace either rotor. At starting, the stator embraced the high-resistance rotor, and as the motor acquired speed, it was traversed gradually to embrace the other. In a later design the machine had two stators having separate windings. The rotors had squirrel-cage windings, and between the two a high-resistance ring connected all conductors. To start the motor the angular positions of the poles remained the same, but the phases were altered with regard to one another, which was done by reversing the current in each phase of one stator. This caused the currents in the two rotors to flow in opposite directions, returning through the high-resistance ring at the centre. The objection to this type of motor was the long shaft required. A later type was designed by Deri. In this the conductors of low resistance were connected in series in a wave winding, but at a number of points were shunted by high-resistance connections. There was the same number of poles on the rotor winding as on the stator. At starting, the number of poles on the stator was halved by means of a change in the connections. This change had the effect of making all the voltages on all the conductors of each of the rotor windings, when added together, produce no pressure. The current, however, had a path through the high-resistance connections, making what is in effect a squirrel-cage winding. In a later machine Deri accomplished the same purpose by changing the number of poles from eight to six or from ten to eight, instead of halving them. The author's motor has a selective winding which does not require a complicated switch gear. By means of a simple switch the stator windings may be changed from north-south-north-south to north-south-south-north. The rotor has a wave winding of low resistance, and a squirrel-cage winding of high resistance. When starting, the last-mentioned arrangement of field poles is employed. This arrangement causes one-half of the wave winding to oppose the other half, so that no current will flow through it. The squirrel-cage winding, however, is active, and the motor starts as though it had lost one pair of poles. After full speed is attained the normal connection is made, and the wave winding takes up the load.—*Abstracted from the Electrical Review (London), June 30.*

Electric Tanning.

In concluding an article on the actual condition of the tanning industry, MM. Henri and L. François give a brief account of the several electrical methods in use for hastening this process. In 1849 a process was patented in England by Cross, which consisted in the use of an "electric vat," one side of which was coated with sheet lead, and the other with zinc. These two plates were connected together exteriorly by a brass wire. Meritens, in 1874, and Goubard and Kresser, in 1876, suggested causing electrolytic decomposition of the water in the tanning bath. In all of these processes the current employed was small, and the hides were maintained in the liquid without being agitated. In 1866 Worms and Ballé devised a method which maintained the hides in motion during the passage of the current. Their apparatus consisted of a sort of revolving drum four metres in diameter and one and one-half metres high, turning about a horizontal axle through which was introduced the tanning solution. They passed a current of ten amperes at seventy volts through the vat by means of two brushes and slip-rings. Plates projecting radially from the axle acted as electrodes. In tanning by this process the largest hides were finished in five or six days. A calf skin was completed in two days. The leather resembled that obtained by the usual method, but the surface was rather more brittle. The rapidity of the action was thought to be due to the agitation of the hides, and to the presence of certain materials in the solution and the action of the electric current. The hides play the part of porous electrodes, within which gas is disengaged by electrolysis, and which inflates the hides and facilitates absorption of the tanning solution. In the Pieper process the hides are suspended on a vertical axle, by means of which they are moved through the tanning solution. Landin proposed using high-tension alternating currents to prevent the oxidation of the tanning. The author believes that the electric current in tanning has brought into existence an interesting process which offers the advantage of furnishing a tanned hide in a short time and in an economical manner, in spite of the expense of the installation.—*Translated and abstracted from La Revue Technique (Paris), May 10.*

The Self-Operating Mercury Interrupter.

A new design of mercury interrupter was exhibited at the recent meeting of the French Physical Society by M. A. Gaiffe, of Paris. The interrupter is of the turbine type, the revolving part being an iron cone suspended on a vertical spindle, point down. This cone is pierced by an inclined channel opening at the apex and at the rim. As the cone projects below the surface of the mercury when it is revolving, the centrifugal force draws the mercury up through the channel and discharges it at the side in a jet, where it comes in contact with a number of metallic points. Baffle plates arranged in the bottom of the containing-vessel prevent the body of mercury from rotating. The ingenious part of this device is the method by which it is propelled. The upper part of the spindle supports horizontally a four-pointed wheel of iron, which is held just above four electromagnets. The latter are excited by the intermittent current drawn from the interrupter, and the position of the contact points is adjusted so that as the circuit is closed by the stream of mercury a pull is exerted by each coil on one of the points of the wheel. The circuit is opened before the direction of pull is reversed. To start the device it is only necessary to give the wheel a spin with the finger, when it will keep itself running as long as the coil is in use. To regulate the speed of interruption two rheostats are employed, one placed in series with the interrupter and the coil, and the other shunted around the electromagnets. The first controls the current flow, as well as the frequency of interruption; the latter simply varies the frequency of the make and break.—*Translated and abstracted from L'Électricien (Paris), July 8.*

The Evolution of Hydrogen from the Cathode, and Its Absorption by the Anode in Gases.

While making an experimental study of the cathode fall of various metals in helium, it was observed by Mr. C. A. Skinner that, no matter how carefully the gas was purified, hydrogen radiation appeared persistently in the cathode glow when the discharge was tested spectroscopically. Simultaneously with this appearance there was a continuous increase in the gas pressure with time of discharge. Seeking the cause of this unexpected phenomenon, an apparatus was prepared for carefully purifying the helium and eliminating all other gases. Research with this device located the source of this hydrogen in the cathode and showed that the quantity of hydrogen evolved by a fresh cathode obeys Faraday's law for electrolytes, and that a fresh anode absorbs hydrogen according to the same law. Tests were conducted with various metals, under various conditions. The following are some of the interesting conclusions drawn: in fresh electrolytes a hydrogen atom serves in all cases as the carrier of electric current from cathode to gas. With a gas filling of hydrogen the atom serves also as a carrier from the gas to the anode. In helium a hydrogen atom leaving the cathode discharges to the helium, and this transmits the current to the anode, the negative helium ion discharging without being absorbed. There is a considerable concentration of free ions at the cathode surface. They do not discharge to the metal so long as it furnishes hydrogen sufficient to carry the current. This condition may last several minutes. The positive hydrogen ion does not enter into electrical union with a metal, though a negatively charged hydrogen atom is readily absorbed by it. The generally accepted view, that the negative ion in gases is of smaller magnitude than an atom, while the positive ion is of molecular or atomic magnitude, does not hold there. There is evidence that in hydrogen a hydrogen atom carries the current from the cathode to the gas, then again from the gas to the anode. This being true, any other form of ionization in the gas can not be expected. If this occur with hydrogen no other atomic ions should be expected under the same conditions in other gases. In other gases, however, the conditions are modified, since the negative hydrogen atom freed from the cathode might serve as an active ionizing agent. Some light is thrown by the experiments upon the problem as to why positive gas ions do not discharge to a negative metal, but instead draw out of the metal the negative hydrogen ions. An intimate association in the atomic form is necessary to a transmission of charge from gas to metal. Hydrogen in acids is universally the carrier of positive electricity. In solutions of metallic salts the metals carry universally the positive charge. In these experiments, however, there is an electrical union of hydrogen with the metals, and the hydrogen becomes the carrier of the negative charge. The natural union, therefore, of all gases with metals should be that where the metallic atom is positively charged and the gaseous atom negatively charged. If this condition be reversed a union only takes place under very great external forces.—*Abstracted from the Physical Review (Lancaster), July.*

Tests on Starting Transformers.

A study has been made by M. C. N. P. Johann of the phenomena occurring when a transformer is connected suddenly to a source of potential. The author finds that when a continuous current is started in a transformer that the current does not increase according to the exponential law; that the ratio of the tangents to the theoretical and the actual curves of current growth, drawn from the origin, is about three to one. If the secondary circuit is closed on a resistance, the primary and secondary currents vary, first very quickly, and then more slowly than is the case if the secondary circuit be opened. The form of the curve is modified by the saturation of the iron, causing it to rise slowly at first to a point of inflection, and then to rise quickly. The remnant magnetism varies the curve, the variation being different for different points in the hysteresis cycle. Applying an alternating electromotive force of sinusoidal shape to the same transformer, the curve of current growth is different for different phases of the electromotive force when the circuit is closed. When the circuit is first closed the current may reach a value which will be greater than that flowing after some time, due to the remnant magnetism in the iron. If the primary circuit of a transformer is closed at any moment whatever, the current which will flow will not be greater than the final value if the condition of the iron represents a point on the regular hysteresis loop. The form of the curve during the period of establishment depends upon the value of the voltage at the moment of closing the circuit; on the ohmic resistance; on the electromotive force due to hysteresis; on the fall of potential due to Foucault currents; on the saturation of the iron; on hysteresis, which destroys the symmetry of the curve; and finally upon the magnetic viscosity, which has the effect of enlarging the hysteresis cycle. The time required for the current to come to its normal value is limited by the fall of potential due to ohmic resistance. If this is low the final value is reached slowly; if it is great, quickly. The action of Foucault currents is similar to that of ohmic resistance. If the secondary is closed on a resistance the primary current is the superposition of the idle current upon the secondary current. The time required for its normal value to be reached is then shorter, because of the increased loss due to ohmic resistance.—*Translated and abstracted from the Bulletin de la Société Internationale des Électriciens (Paris), June.*

INDUSTRIAL SECTION.

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

General Electric Company's National Electrical Code Standard Enclosed Fuses and Cutouts.

The General Electric Company, Schenectady, N. Y., is now furnishing a com-

250-VOLT, 31-60-AMPERE FUSE.

plete line of National Electrical Code standard enclosed fuses and cutouts ranging from 3 to 600 amperes in both the 250 and 600 voltages. The cutouts

250-VOLT, 65-100-AMPERE FUSE.

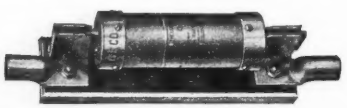
and fuses are uniformly compact and durable and the insertion or removal of the fuses is easy and safe.

For fuses rated from three to thirty amperes, 250 volts, cutouts similar to the Edison plug cutouts are furnished, and for fuses from thirty-one to sixty amperes, 250 volts, two and three-wire main line and single branch cutouts are supplied. All other sizes of fuses are provided with

250-VOLT, 30-AMPERE RENEWABLE FUSE PLUG.

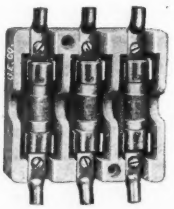
single pole cutouts. With all cutouts are used the General Electric wrought-copper cable terminals, with the exception of the thirty-ampere, 250-volt sizes. These are provided with washer and screw terminals.

The fuses are of the well-known en-



SINGLE-POLE, 600-VOLT, 401-600-AMPERE CUTOUT.

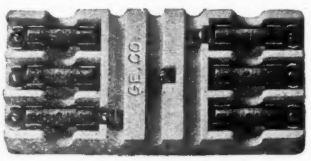
closed fuse type, ferrule or knife-blade contacts being used according to the requirements of the code. The knife-blade type, in addition to the standard parts, has a brace placed in each end of the tube to engage the screws which hold the end caps in place. The brace is rigidly attached to the contact blades. This forms a strong mechanical joint which does not depend solely upon the shearing strength of the fibre tube. The knife-blade contacts are of punched copper, and when



THREE-WIRE, MAIN LINE, 250-VOLT, 3-30-AMPERE CUTOUT.

used with the standard switch clips provide the best form of contact. The parts being copper of high conductivity and generously proportioned the heating is reduced to a minimum.

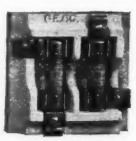
In the ferrule type the contacts are made by phosphor-bronze clips designed



THREE-WIRE, DOUBLE BRANCH, 250-VOLT, 3-30-AMPERE CUTOUT.

to give the utmost contact and elasticity in the smallest possible space.

The renewable fuse plug consists of a brass tube with the lower end threaded to fit the standard screw shell, and the upper part insulated by a porcelain shell. There is also in the upper end a spring clip which receives the ferrule contact of



TWO-WIRE, CROSS-OVER, 250-VOLT, 3-30-AMPERE CUTOUT.

the reload, the ferrule on the other end forming the centre contact of the plug. The reloads are the thirty and sixty-ampere, 250-volt enclosed fuses.

Instructions for Installing Stombaugh Guy Anchors.

W. N. Matthews & Brother, 219 North Second street, St. Louis, Mo., have recently published some descriptive matter giving instructions for installing Stombaugh guy anchors. These instruction sheets have proved decidedly popular,

FIG. 1.—FIVE AND SIX-INCH RODLESS GUY ANCHOR.

and the illustrations are reproduced herewith.

Fig. 1 shows the five and six-inch rodless form of guy anchor, Fig. 2 the five and six-inch rod form, and Fig. 3 the eight, ten and twelve-inch form of anchor. The method of installation is as follows: a piece of galvanized strand or wire seven or eight feet long is attached to the eye of the anchor and passed through the hollow pipe of the wrench. The anchor is firmly keyed to

FIG. 2.—FIVE AND SIX-INCH ROD GUY ANCHOR.

the wrench, the wire drawn tight and firmly clamped flush with the cross of the wrench. This is shown in Fig. 4. It is important that the wire be tightly clamped above the cross, as otherwise the wrench will slip away from the guy anchor. The anchor is then screwed into the ground at the angle the guy wire is to run. This is carried to such a depth as the ground conditions will permit. When the anchor is installed at the greatest depth possible, the wire is unclamped, the wrench pulled out, and the guy wire

attached to the strand which is connected to the anchor.

The method of handling the five and six-inch rod anchor is somewhat similar. The anchor is keyed firmly to the wrench, and a metal or wooden wedge is driven

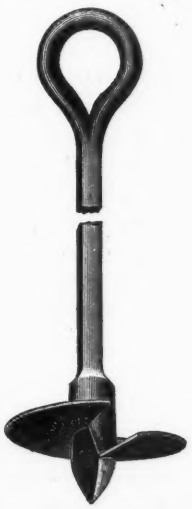


FIG. 3.—EIGHT, TEN AND TWELVE-INCH ROD GUY ANCHOR

into the eye of the rod to keep the wrench from slipping. The anchor is screwed into the ground at the same angle the guy wire is to run, and when sunk as far as possible the wrench is removed and the guy wire attached to the eye of the rod.

The method of installing the eight, ten

FIG. 4.—METHOD OF INSTALLING THE GUY ANCHOR.

and twelve-inch rod anchors is just as simple. A bar or other lever is placed in the eye of the anchor, and the anchor is screwed in as far as the ground conditions will permit. When the anchor is set the guy strand is attached to the eye.

Sargent Steam and Compressed Air Meter.

The demand for a practical device which will measure or indicate to the observer the weight of steam flowing through a pipe has led to the invention of the Sargent steam and compressed air meter, an instrument which will indicate

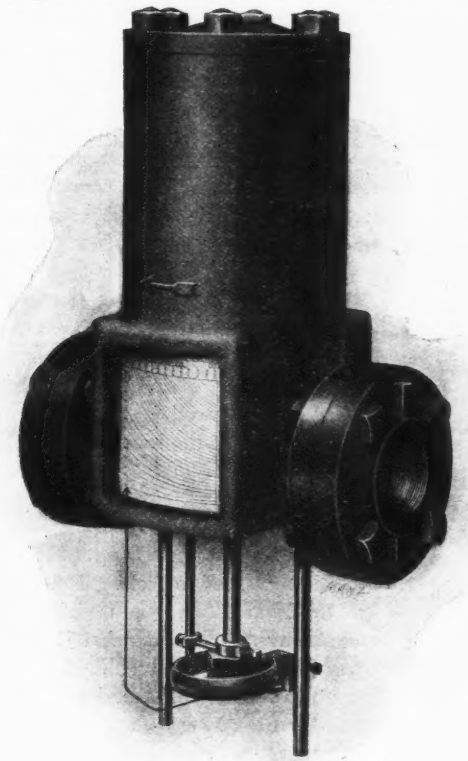


FIG. 1—SARGENT STEAM AND COMPRESSED AIR METER.

the weight of steam or horse-power irrespective of the pressure.

As this instrument is calibrated by weighing the steam passing through after condensing in a surface condenser, the indications in service must coincide with the indications determined in calibrating the meter, as the pointer necessarily has a different position for different quantities of steam flowing through, and also a different position for different pressures. A meter carefully calibrated must be correct when used in practice.

Fig. 1 shows the improved form of the Sargent steam and compressed air meter. It is connected up in the steam pipe or by-pass, which allows all the steam that is to be measured to pass through, and this amount is indicated by the position of the needle on the dial. Meters are made "right" and "left," so that when looking at the dial the steam may flow toward the right or left as purchaser desires.

Fig. 2 shows the valve, valve stem and spring, showing the passage of the steam and the moving parts. Steam enters from the left, and rising up around the valve stem guide, passes through a small hole and as the pressure increases raises the valve, allowing the steam to pass down between the cones and the valve seat to the discharge side of meter. As the valve stem *k* is open to the atmos-

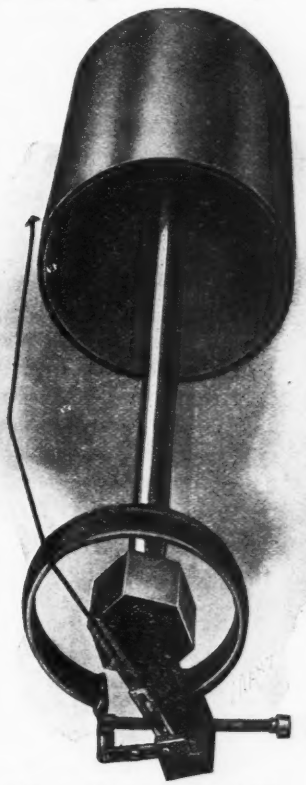


FIG. 2.—VALVE, VALVE STEM AND SPRING.

phere, the pressure on the discharge side of the meter tends to close the valve and force it to its seat. As the area of the valve steam is about two per cent of the valve area, it follows that there will be a two per cent difference in the pressure between the outlet and inlet side of meter, and that to maintain the difference the valve will assume new positions, depending on the quantity of steam flowing through. If the steam pressure were constant the rise of the valve would be in proportion to the weight of steam flowing through, but as the pressure increases more steam will go through a constant opening; or, what necessarily happens, as the weight remains constant the opening will be less as the pressure increases. In order to compensate for variations in pressure a Bourdon spring is connected to the bottom of valve stem which moves the needle transversely as the pressure varies. With a constant weight of steam flowing through, the valve would be open twice as wide for fifty pounds pressure as it would be for 100

pounds pressure, from which we see that the horse-power lines go down as the pressure goes up. The meter is calibrated by weighing the condensed steam flowing through under different pressures and valve openings, and the trial dial thus obtained is transferred to the permanent metal dial of the meter. As the meter has but one moving part it is not liable to get out of order.

The meter is manufactured in sizes one inch to six inches by the Sargent Steam Meter Company, 1290 First National Bank Building, Chicago, Ill.

Electricity for Closing Bulkhead Doors.

It has been rumored, says the *Western Morning News,* Plymouth, England, several times that at last the admiralty have decided to deal with the question of watertight doors in a drastic manner. The present system is in many respects unsatisfactory, and there is no evidence that the admiralty have profited by the terrible lesson conveyed by the "Victoria" disaster. Curiously enough, the navy which has most energetically faced the problem is that of the United States. In sixteen of its newest warships and cruisers what is known as the "Long Arm" system has been adopted. By this means the bulkhead doors and armor hatches are electrically operated in such a way that the officer at the central station on the bridge by turning a wheel can close any one of the doors and the hatches. While control is exercised from this central station, there is no interference with local control. The officer on the bridge has the assurance that in closing any doors in case of emergency he is not endangering the life of any one who may be in one of the compartments, because any such man, on wl ichever side of the door he may be, has within easy reach a handle by which he can himself control the movement of the door for sufficient time to enable him to escape. The system is worked by electricity instead of by hydraulic power, which is a considerable advantage, since the few wires which are necessary may be laid throughout the ship without difficulty. The "Long Arm" system has been in operation in the American navy for a considerable time. The doors are tested every month, and the crew thus have every opportunity of becoming familiar with the system. In the "Victoria" disaster we had an illustration of the terrible results of an inadequate system of bulkheads. If the cellular structure of the ship is to be preserved and means of communication provided from compartment to compartment, it is essential that the officer on the bridge should be able to control the whole installation.

The "Long Arm" system of control possesses the advantages of electrical control from a central station without endangering any of the crew by the sudden closing of a door. The American navy is the only one which has adopted this method of dealing with the bulkhead door difficulty. It is said that the British admiralty propose to remove the source of danger by abolishing all communication by means of doors, each compartment being absolutely sealed and connection from one to another obtained only by means of passage above the water-line. It is evident that this method, if severely adopted, will lead to great waste of time and energy, and it will be interesting to know whether the authorities at Whitehall have seriously taken into consideration the solution of the problem which has recommended itself to the Navy Department at Washington. It is certain that the British naval attaché in the American capital has studied the "Long Arm" system and forwarded reports. These may quite conceivably have been unfavorable to the "Long Arm" system, but if this be the case, they are in direct conflict with the mature opinion of American officers. The authorities of the United States Navy appear to be more completely impressed in favor of the "Long Arm" system year by year, and it would be surprising if the present board of admiralty did not strictly investigate its claims before embarking upon a method of complete subdivision, which can not fail to lead to great inconvenience and might in certain circumstances be inimical to safety, owing to the impossibility of getting from one compartment to another and ensuring satisfactory ventilation. Possibly, however, there is no solid foundation for the decision which rumor attributes to the board of admiralty.

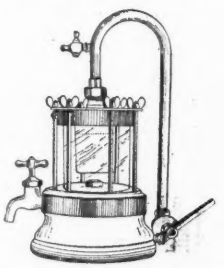
The Available Supply of Platinum.

The Croselmire & Ackor Company, 42 Walnut street, Newark, N. J., platinum, gold and silver refiners, announce that the situation in Russia is becoming so serious, and the supply of available ore so scarce, that it is possible, and not at all improbable, that before the first of the year it will be almost impossible to purchase platinum in quantities of any account. Prices are advancing almost daily, and in the next month or so the price of platinum will be very high. Platinum to-day is worth from $21 to $21.50 per troy ounce, according to the quantity.

An Electric Water Purifier.

The Electric Water Purifier Company, 52 Broadway, New York city, has placed on the market an electric water purifier, the invention of Mr. M. F. Adams, the vice-president and general manager of the company.

The accompanying illustration gives a good idea of the appearance of this purifier. The apparatus consists essentially of two platinum receptacles, one smaller than and fitting inside of the other. Each of these platinum receptacles has a ring of perforations about three-quarters of an inch below the open top. The receptacles are further fitted with one-eighth-inch felt filtering pads. Each receptacle is locked to a hard-rubber or ebonite top by a bayonet catch. As the receptacle is locked to the top support, contact is made with a terminal and binding-post, to which connection is made from the source of current. From a battery of six dry cells one leg of the circuit is carried to a switch cock, which also performs the function of



ELECTRIC WATER PURIFIER.

turning on and off the water supply. Current goes from this switch cock to one binding-post, making contact with the inner platinum receptacle. From the binding-post making contact with the outer platinum receptacle a lead is led back to the primary battery. The water is passed through the main supply pipe into the smaller receptacle, forced through the perforations and the felt pads by its own pressure, and then through the felt pads and the perforations of the larger platinum receptacle, into a glass containing-jar or cylinder. The hard-rubber or ebonite top is made air-tight and watertight by a soft-rubber seal, and a series of bolts secured with thumb nuts. While the water is flowing, current is passed from one platinum receptacle to the other, effecting an electrochemical deposition of any metallic salts which may be held in suspension, and also effectually destroying, the inventor states, any micro-organisms or bacteria which may exist in the water. In this way the drinking water is rendered very pure and highly palatable.

The inventor states that with a battery of six dry cells enough water can be drawn to supply all the wants of a large family for at least six months.

A New Pendant Quick-Break Switch.

The Sarco Company, 906 Sixth avenue, New York city, has placed on the market a new form of quick-break pendant switch. This switch was exhibited at the recent electrical exhibition in Mechanics' Hall, Boston, Mass., and attracted a great deal of attention.

This pendant switch is decidedly ingenious in many ways. It is made up in various finishes, and, outside of its utility, presents an attractive appearance. The switch proper is mounted in a solid piece of porcelain, and consists essentially of two levers working on a rocker, causing, by means of two spring triggers and a double V-cam, the reciprocation of the copper switch jaws.

In the up-and-down movement of the two levers the movement is guided by the construction of the porcelain holder, so that the action is that of a quick-break switch. In other words, there is no action

NEW PENDANT QUICK-BREAK SWITCH.

whatever of the switch jaws until the apparatus is ready to make a quick, clean break. There is no danger of arcing, and although the apparatus is rated at 125 volts and six amperes, under test it was impossible to burn it out with ten amperes.

The switch contacts and leading-in wires are separated by a mica insulation, and the contacts are of ample area for the voltage and current. The fittings are made of cast brass, and copper of high conductivity. The double V-cam, which gives to the snap switch its reciprocating motion, is made of steel, and the whole apparatus is so proportioned and constructed that it will wear indefinitely. The push levers for operating the switch are marked for on and off, one lever being inlaid with pearl, and the other concaved and knurled.

In addition to these features the switch is made with a threaded bushing, so that it can take either standard or reenforced cord. All that is necessary in either case is to unscrew the nipple from its bushing.

This switch has been tested and endorsed by the National Board of Fire Underwriters.

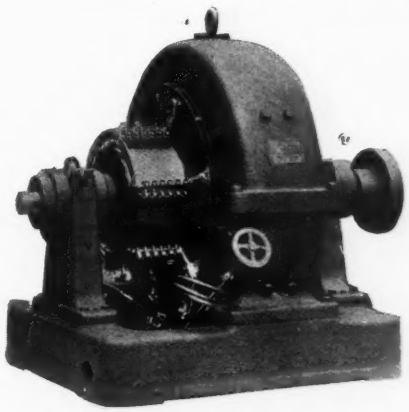
Direct-Current Self-Contained Generators and Polyphase Induction Motors.

A new line of direct-current, self-contained generators, designed by the Westinghouse Electric and Manufacturing Company for railway, lighting and industrial service at 125, 250 and 550 volts, is shown in the accompanying illustrations. These generators are adapted for belt driving or for direct connection to waterwheels, steam engines or other prime movers where frames with bearings are desired. While their general appearance differs from earlier forms, the essential features characteristic of Westinghouse apparatus have been retained and the changes consist chiefly in the more efficient use of the materials employed in their construction and of mechanical modifications which make possible a more effective adaptation of the generators to modern methods of driving.

The frame consists of a circular yoke of cast-iron divided horizontally into two parts and mounted upon a bed-plate of cast iron, to which are bolted the pedestals which carry the armature bearings. Laminated poles with spreading tips are bolted to the frame and any pole and its coils may be removed without disturbing either the armature or frame. The inner surface of the yoke is carefully machined to form a seat for the pole-pieces, which are shaped to fit.

The shunt and series field coils are separately wound and are held in place by the spreading pole tips. Ventilating spaces are provided between the coils and between coils and poles in such a way that thorough ventilation is secured. The coils are taped and impregnated by processes which make them entirely moisture proof. The field windings are regularly proportioned so as to provide an increase of potential of about ten per cent at the terminals from no load to full load, though other compounding may be obtained if desired.

The armature core of the slotted drum type is formed of carefully annealed punchings built up on a cast-iron spider, on an extension of which the commutator is mounted. Liberal ventilating ducts make possible a thorough circulation of air while the machine is in operation. Coils formed of copper strap are used, and are held in their slots by fibre wedges. The generous proportions of the commutator



250-KILOWATT DIRECT-CURRENT GENERATOR.

ensure the best commutation and low temperatures under all normal conditions of operation.

No part of the rocker ring supporting the brush-holder arms projects over the commutator, thus leaving the carbon holders and commutator readily accessible at any point. The carbon holders are of the sliding type with shunts, the tension on the brushes being obtained by long, flat, spiral springs, which give a uniform pressure over a wide range of

150-KILOWATT DIRECT-CURRENT GENERATOR.

movement without change in adjustment. The brushes and moving elements are light and follow the surface of the commutator without chattering.

Separate pedestals bolted to the bedplate support bearings of the Westinghouse self-oiling type, which consist of cast-iron shells lined with babbitt metal and lubricated by means of rings which ride upon the shaft and dip into large

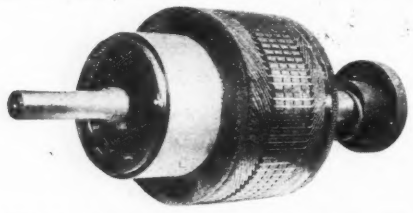
reservoirs filled with oil. The bearing housings and shells are divided horizontally into two parts to facilitate mounting and removal.

In the larger multipolar machines with parallel wound armatures sparking at the brushes, wasteful heating in the armature

Pillow Block, with Cap Raised, Showing Bearings.

winding and abnormal magnetic strain upon the armature—troubles occasioned by inequality in material or by displacement of the armature from the centre of the field—are completely obviated by the following method of balancing the magnetic circuit. A number of points in the armature winding which are normally at equal potential are connected by leads through which balancing currents may pass from one section of the winding to others. These correcting currents are alternating in character, leading in some coils and lagging in others and consequently magnetize or demagnetize the field poles in such a way as to produce the necessary magnetic balance.

Skilful design and construction, thorough ventilation and proper proportioning of all parts, and the effective use of the

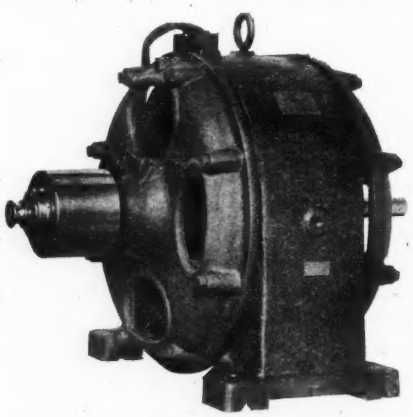


250-Kilowatt Direct-Current Generator Armature.

material employed result in superior operating characteristics and a generally successful performance. Even in the most severe service the temperature of these generators is low. The efficiency is high, the regulation close, commutation is sparkless and the generators, the maker states, are thoroughly reliable in every respect.

The Westinghouse type HX motor, illustrated herewith, is designed for constant-speed service and belongs to that class of induction motors without contacts or any connection whatever between the supply circuit and the rotating element. The starting mechanism is mounted on the shaft external to the frame, and consists of a device by means of which resistance is inserted in the winding of the revolving part when starting and gradually cut out as the speed increases until the winding is short-circuited. Thus, by a gradual development the starting current becomes practically the running current, which is a very important feature on small systems where a constant voltage is essential and which would be considerably affected by throwing the motor suddenly on the line.

The frame of the motor is a solid ring of cast iron with feet for supporting the machine. Slide rails may be used or not



Westinghouse Type "H" Motor.

as desired. The core carrying the stationary windings is built up of steel punchings which exactly fit the bore of the frame and which are firmly held together between two iron rings. Substantial brackets carrying the bearings for the rotating element are bolted to the cast-iron frame, and may be fastened in four positions, permitting the motor to be mounted on the floor, side wall or ceiling, and the oil reservoirs to always be in the proper position. By means of oil rings revolving in the reservoirs copious lubrication is provided for the motor while in operation.

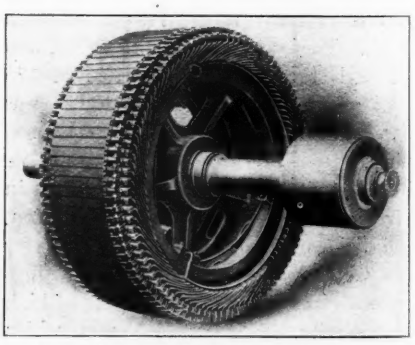
To secure the starting characteristics above mentioned the secondary windings are similar to those of a polyphase generator. Insulated copper bars are inserted in the partially closed slots in the steel punchings of the rotor. These punchings are mounted on a cast-iron spider which is keyed to the shaft. The overhanging tips of the teeth hold the bars in the slots. The end connectors are secured to the bars after they are in place and the leads are brought out through the hollow shaft to contacts in the starting device. This consists of a resistance which is cut in and out of the circuit by a sliding contact, and is so arranged that as the motor accelerates it may be gradually cut out by

Type "H" Motor for Use on Wall.

pushing in the cylinder, until for normal running the winding is short-circuited. In this movement the resistance is cut out by what amounts to an infinite number of steps. The starting device may be operated by a lever rigged in a manner similar to an ordinary belt-shifting device.

The case of the starter is a cast-iron cylinder of enclosed construction, and, being dust-proof and sparkless in operation, may be used with impunity in the presence of inflammable vapor or dust-laden air.

These motors are built for two and three-phase circuits, in sizes from five to fifty horse-power, for 3,000 and 7,200 alternations. Standard voltages are 100, 200 and 400 for machines up to twenty horse-power, and 200 and 400 volts from



Secondary Complete, with Starter.

twenty to fifty horse-power. The motors retain a high efficiency even on light loads; therefore their all-day efficiency is very high, as in general service motors may operate on light loads much of the time. The speed regulation between no load and full load has been found by test to be very small, a valuable feature in many applications.

CURRENT ELECTRICAL NEWS

DOMESTIC AND EXPORT.

ELECTRIC POWER IN MINES—The electric power plant of the Delaware & Hudson Coal Company, at Wilkesbarre, Pa., is being enlarged, and within the next few weeks the company will operate and illuminate all its collieries by electricity. The small locomotives will be displaced by motor cars, and the mine mules will be eliminated.

ELECTRIC LIGHTING FOR NEW YORK CITY—The report presented some time ago to the board of estimate and apportionment for the city of New York by the commission on electric lighting for New York city has been referred to Mr. Lewis, chief of the board of estimate, to make a synopsis. Mr. Lewis has reported, and the board has approved his report and authorized him to prepare specifications for a contract for submission to the corporation counsel. It is expected that Corporation Counsel Delany will accept the plans for contracts early in September, and that at the next meeting of the board of estimate the work of erecting the plant will be authorized.

NEW TELEPHONE COMPANY—Articles of incorporation of the Atlantic Telephone Company, with a capital of $5,000,000, have been filed with the county clerk in Kings County, N. Y. All of the stock is common, each share being of the par value of $100. The objects of the company, as stated in the papers, are to furnish telephone, telegraph, telautograph and other means of electrical communication and messenger service in the cities of Buffalo, Syracuse, Rochester, New York and other cities on the Atlantic coast. The incorporators are William H. Staylen, Yonkers, N. Y.; James A. L. Campbell, borough of Manhattan; Charles B. Reid, Manhattan; George H. Newman, Brooklyn; Warren L. Sawyer, Nyack, and James G. Shaw, Manhattan.

TELEPHONE MERGER—It is stated that details have been completed for the absorption of the Kinloch Telephone Company, of St. Louis, Mo., by the Kinloch Long-Distance Telephone Company, of Missouri. The shares of the local company, representing an issued capital stock of $2,000,000, have been exchanged, share for share, for stock of the Long-Distance company. The authorized capital of the latter corporation is $5,000,000, of which $2,800,000 has been issued, including the shares exchanged for the Kinloch Telephone Company's stock. The companies, while owned by the same interests, will be conducted as heretofore by separate managements and officers. They will be financed jointly, however, and will be governed by the same board of directors. Mr. Samuel M. Kennard, president of the Kinloch Telephone Company, has resigned because of ill health, and the press of private business. Mr. William F. Nolker, vice-president, has been elected to succeed him. In the Long-Distance company the directors are Adolphus Busch, C. Marquard Forster, August Gehner, Breckenridge Jones, Samuel M. Kennard, W. F. Nolker, Rollo Wells, Philip Stock, Julius S. Walsh, William D. Orthwein, W. J. Lemp, James Green and Henry Nicolaus. The board of directors of the local company is as follows: Adolphus Busch, C. M. Forster, August Gehner, Breckenridge Jones, S. M. Kennard, W. D. Orthwein, Charles H. Ledlie, W. J. Lemp, Henry Nicolaus, Philip Stock and Julius S. Walsh. C. M. Forster is president of the Kinloch Long-Distance Telephone Company.

EXTENSIVE PURCHASES OF RIGHT OF WAY BY THE NEW YORK, WESTCHESTER & BOSTON RAILWAY COMPANY—Up to the time of the approval of its amended route by the board of estimate and apportionment, the New York, Westchester & Boston Railway Company had been obliged to conduct the purchase of its right of way in The Bronx in a somewhat roundabout manner. Now that the amended route is approved the company announces the purchase of considerable right of way. The revised route of the Westchester road, as approved by the board of estimate on June 14, between West Farms road and the northern line of New York city, is a material improvement over the original route, in that it gives almost a direct line from Bronx Park to the city line at Mount Vernon. This will facilitate the operation of the road and make it possible to maintain high speeds. Contracts will be let shortly for the construction of the entire Westchester line in The Bronx, including the section running up to Mount Vernon. William A. Pratt, chief engineer of the company, has supplied blank proposals and articles of agreement, the specifications including grading, clearing and grubbing, ditching and drainage, masonry and brickwork, tunneling, concrete, timber, iron, etc. It is made a part of the specifications that all work under the contracts to be let by the end of July shall be commenced within ten days. Another paragraph of the specifications is that which states that "the contractors will be required to construct all viaducts over streets and tunnels under streets, and all bridges necessary to carry the streets over the railway, in such a manner as not to interfere with the ordinary use of the street or road as a public highway, and shall protect and keep in service all sewers, conduits, gas, water and other pipe lines, and all street railway tracks and appurtenances."

OBITUARY NOTICES.

MR. JAMES B. GILL, Buffalo, N. Y., a well-known electrician, died on Friday, July 7. Mr. Gill took an active part in installing the fire-alarm and messenger-call systems in Buffalo. Four years ago he accepted a position with an eastern company, leaving Buffalo. He was born in Cleveland, Ohio, fifty-five years ago. A wife and son, James B., survive him.

MR. WILLIAM JESSOP died on July 4 at his country home, Thornsett Lodge, Bradfield, England, after a long illness. Mr. Jessop was born in October, 1856. He was educated at Repton, Germany, and at Cambridge, England. At the time of his death, and since 1887, he was chairman of William Jessop & Sons, Limited, steel manufacturers of Sheffield, England. He was the head of the fourth generation of the Jessop family in control of the firm, the business having been established in 1774. He was president of the Jessop Steel Company, of Washington, Pa.; president of the Jessop Hospital for Women, an institution founded by his father, the late Thomas Jessop. He was also a trustee of the Sheffield Royal Infirmary, and a member of the Bradfield Game Association. He was formerly a director in the Sheffield & Rotherham Bank and the Yorkshire Engine Company. He was a large land-owner, and worked an estate of 4,000 acres at Huggat, in the northeast of England, and an estate at Fosdick.

COLONEL DANIEL SCOTT LAMONT died at 9.15 o'clock on the evening of July 23, at his country home, Altamont, Milbrook, Dutchess County, N. Y. Colonel Lamont's death was very sudden, as he had been entertaining several guests from New York and had been out driving during the afternoon. It is understood that he suffered an attack of heart disease. Colonel Lamont was born of Scotch parents on February 9, 1851, at Cortlandville, N. Y. His early education was secured in the common schools, and was continued at the New York Central Academy at McGrawville. In 1868 he entered Union College, but did not finish, as he was appointed deputy clerk of the assembly a year before the time for graduation. This was his first step into politics, and for the twenty-eight years that followed, or until he resigned as Secretary of War in President Cleveland's cabinet in 1897, he was a factor of considerable political importance. In 1889 he allied himself with William C. Whitney and Colonel Oliver H. Payne in New York city in the enterprise which resulted in the consolidation of all the street car lines in Manhattan under the name of the Metropolitan Traction Company. He took a personal interest in the rehabilitation of the system, and it was largely through his efforts that the traction interests in New York city became so popular with the traveling public. In 1893 he was appointed Secretary of War, serving until 1897. In 1897 he was elected vice-president of the Northern Pacific Railway, and president of the Northern Pacific Express Company. In 1874 Colonel Lamont married Miss Julia Kinney, of Cortland County. He was a member of the Metropolitan, Colonial, Lotos, Lawyers' and Democratic clubs, the Union Alumni Association, and the Metropolitan Museum of Arts.

TELEPHONE AND TELEGRAPH.

WENDELL, MASS.—The Highland Telephone Company is extending its lines to Wendell Center.

KINGSTON, N. Y.—The Hudson River Telephone Company is arranging for the erection of a central office building.

MILWAUKEE, WIS.—Plans are said to be under consideration for additional long-distance lines between Chicago and Milwaukee.

LOS ANGELES, CAL.—The Western Union Telegraph Company has ordered two new wires strung between Los Angeles and Salt Lake City.

McCOOK, NEB.—The Nebraska Telephone Company is making arrangements to improve the local telephone exchange. About $15,000 will be expended.

RIVERHEAD, L. I.—The Baiting Hollow & Roanoke Telephone Company has completed its line across Long Island to East Quogue. A large number of telephones are shortly to be connected.

MOORESTOWN, PA.—The township committee has accepted the proposed plan of the Bell Telephone Company to lay conduits on several of the principal streets, and work is expected to commence shortly.

MERIDIAN, MISS.—Work has been begun by the Cumberland Telephone and Telegraph Company on its system of underground wires for the business section. The new system will be thoroughly modern in every respect.

NASHVILLE, TENN.—The Cumberland Telephone and Telegraph Company has secured a permit to erect a branch telephone exchange on West Church street. The new exchange will be constructed of brick and will cost $8,000.

PARSONS, KAN.—The Southeastern Telephone Association, at its meeting, elected the following officers: president, C. H. Kimball, of Parsons; vice-president, J. M. Dasbaugh, Cedarvale; secretary and treasurer, M. L. Robeson, Galena.

PORTVILLE, N. Y.—The Inter-Ocean telephone lines are being extended up Knights creek from Scio, and within a month probably twenty instruments will be installed on the lines between Scio and Allentown. These wires will run direct into the Wellsville exchange.

JOHNSTOWN, PA.—The stockholders of the Huntingdon & Clearfield Telephone Company, at their annual meeting in Clearfield, decided to run two new trunk lines from Patton to Ebensburg and Cresson and push work on the Indiana County line. W. L. Malin was reelected superintendent.

COLUMBUS, OHIO—The Central Union Telephone Company has issued a statement showing the number of Bell instruments in use in Ohio May 1, as compared with January 1. On January 1, 1905, there were 130,011 Bell telephones in Ohio. May 1, there were 142,237 Bell telephones, an increase of 12,226. This gain is at the rate of 40,000 a year.

ABERDEEN, MISS.—The Citizens' Telephone and Telegraph Company has sold its lines and franchises to the Cumberland Company, which is now in full charge. The latter company will make many changes and improvements in the plant and service, bringing it strictly up to date. Manager F. P. Buford will continue in charge at Aberdeen, and expects to extend the country lines.

COLUMBUS, OHIO—The construction of a new $75,000 cable admitting of the addition of from 4,000 to 5,000 telephones in Columbus, the building of an additional long-distance circuit between Columbus and Dayton and new toll lines between other cities of the district, as well as the erection of new pole lines for the use of farmers, were decided upon at a meeting of the superintendents of the Columbus district of the Bell Telephone Company.

DOVER, DEL.—At a meeting of the directors of the Diamond State Telephone Company the final merger and consolidation of three companies in Maryland, two in Virginia and one in Delaware were consummated and made absolute. The number of directors was increased from seven to ten, the additional three being W. R. Driver, of Philadelphia; Frederick R. Owens, of Denton, Md., and W. A. Burton, of Only, Va. Appropriations were made to complete the line to Cape Charles, Va., work on which is being pushed with all speed possible.

WOONSOCKET, R. I.—The new rates of the Providence Telephone Company have gone into effect. For one-party line business connection the new rate will be $54 instead of $66, the old rate. On two-party line business the new rate will be $42, which is $6 less than the old rate. The new rate on a fifteen-party line will be $24 for a business connection. One instrument, residence connection, costs $40 instead of $54 on a one-party line, while the rate per instrument on a two-party line, residence connection, is $30 instead of $36. The new rate on a four-party line is $25 and on a fifteen-party line $18. The six-party line has been abolished, that is, reduced to a four-party line, and the price remains the same, $25.

CINCINNATI, OHIO—The Cincinnati & Suburban Telephone Company has made a substantial reduction in the telephone rates for all classes of unlimited service. There will be no five-year contracts hereafter. All contracts will be for one year, and the rate will be on the same basis that it was for a five-year contract. The unlimited business service is reduced from $125 to $100; residence telephones, individual lines, from $72 to $60; two-party lines, from $60 to $48; three-party lines, from $48 to $36; four-party lines, from $36 to $30. Heretofore the lesser figures have only been for those who would sign a five-year contract with the company. The new rule and rates go into effect at once. At present there are a large number of those having four-party line residence telephones who pay $36; this is now dropped to $30.

NEW PUBLICATIONS.

ANNUAL REPORT OF THE COMMISSIONER OF EDUCATION—The second volume of the annual report of the commissioner of education, Department of the Interior, Washington, D. C., has been received. This report covers the year 1903, and in addition to a large mass of information on education in general, it contains very complete statistics of the technical schools.

SIXTH ANNIVERSARY OF THE NEW LONG-DISTANCE TELEPHONE COMPANY—The report of the sixth anniversary of the New Long-Distance Telephone Company and the Indianapolis Telephone Company, held at Indianapolis, Ind., May 10, 1905, is ready for distribution. In addition to the addresses, menu, and some facts and figures concerning the property, there is a memorial to the Hon. S. P. Sheerin, late president of the company, and a statement by Louis Hollweg, president-elect, regarding the future plans of the company.

THE TECHNOLEXICON—The universal technical dictionary which is being published by the Society of German Engineers in English, German and French is making satisfactory progress. The editor-in-chief reports that about 2,000 firms and individual collaborators at home and abroad have taken part in the work, and that up to the present 2,700,000 word cards have been collected. To these will be added hundreds of thousands of cards as a result of the working out of original contributions not yet at hand. Up to June of this year 1,480 reports had been received. The preliminary work will be finished in the middle of 1906, and printing will begin at the end of that year. This will take up about three years. Further information in regard to this dictionary may be obtained from the editor-in-chief, Dr. Hubert Jansen, whose address is Berlin (N. W. 7), Dorotheenstrasse, 49.

YEAR BOOK OF THE ENGINEERS' SOCIETY OF THE UNIVERSITY OF MINNESOTA—The year book for 1905 of the Engineers' Society of Minnesota contains a number of interesting contributions. Messrs. F. C. Cutter and H. E. Gerrish describe a modern railway test conducted by the Great Northern Railway Company on one of its Montana divisions. Mr. E. H. Scofield, electrical engineer for the Twin City Rapid Transit Company, under the title "The Equipment of a Power Plant," gives some data on power station equipment. Mr. William H. Kavanaugh discusses some steam-separating tests made at the university. Professor Frank H. Constant contributes an article on "The Flexure of Reenforced Concrete Beams in the Light of Recent Research," and Mr. R. S. King describes an oil gas plant installed to furnish gas for the drying of stoves in a foundry, and hardening and tempering furnaces in a blacksmith shop. This issue also contains some interesting curves obtained in tests on the lines of the Twin City Rapid Transit Company.

PERSONAL MENTION.

MR. W. C. WOODWARD, of Providence, R. I., was a New York visitor this week, having recovered from an illness of several weeks.

MR. M. H. TURNER, Medina, Ohio, has been appointed manager of the local exchange at Ashtabula of the Central Union Telephone Company.

MR. J. H. DEAN, of Geneva, Neb., has been appointed manager of the Tecumseh (Neb.) station of the Nebraska Telephone Company, succeeding Mr. F. D. Wright, who has been transferred to Omaha.

MR. PAUL A. KIRSHNER has resigned his position as engineer of bridges with the Chesapeake & Potomac Railway Company to accept a similar position with the New York, Westchester & Boston Railway Company.

MR. F. X. STAUB, assistant to Chief Electrician Duncan of the Home Telephone Company, Fort Wayne, Ind., will succeed to the place held by Mr. Duncan, who has resigned to take the position of superintendent of the Sioux City plant.

MR. JOHN J. CARTY, chief engineer of the New York Telephone Company, leaves on Saturday of this week for a sixty-day sojourn in Europe, accompanied by his wife and son. Mr. Carty, who is one of the ablest of our progressive telephone engineers, will devote a portion of his time in investigating European telephone conditions.

MR. GEORGE B. TRIPP, for the past four years general manager of the Colorado Springs Electric Company, has assumed the management of the Colorado Springs Light and Power Company, the gas corporation of Colorado Springs. He retains his position in the electric company. Mr. Ira Miller, formerly manager of the light and power company, will continue as general superintendent.

MR. FREDERICK E. GUNNISON, of Brooklyn, N. Y., has been appointed a state commissioner of gas and electricity for the state of New York by Governor Higgins. Mr. Gunnison is president of the Union League Club, of Brooklyn, and vice-president of the Brooklyn Republican organization. The term of office is six years. The other members of the commission are John C. Davies, of Oneida, and Lucien Shedden, of Clinton.

MR. WILLIAM N. STEVENS has resigned from the service of the Interborough Rapid Transit Company to associate himself with J. G. White & Company, Incorporated, as assistant mechanical engineer in charge of draughting and detail design. Mr. Stevens is a graduate of the Stevens Institute of Technology, and has had considerable experience in engineering and construction. He assisted E. D. Leavitt in the designing of heavy machinery for the Calumet & Hecla mines, and spent three years in installing compressed gas lighting plants for railroad equipment in various parts of the country. He was engaged with the Edison Electric Illuminating Company, of New York, in the designing of power stations and substations, and served as assistant mechanical engineer for the Manhattan Elevated Railway Company on the design of the Seventy-fourth street power-house. Upon the completion of the Manhattan power-house he became associated with the Rapid Transit Construction Company in the design and erection of the power-house, substations, car-barns and subways.

MR. WILLIAM S. BARSTOW, consulting engineer, 56 Pine street, New York city, and Mr. Frank R. Chambers, recently of the office of J. G. White & Company, Incorporated, New York, have formed a copartnership as consulting engineers to do a general engineering business in the West. The firm of Barstow & Chambers has opened offices in the Failing Building, Portland, Ore., and will maintain an office at 56 Pine street, New York city, thus keeping in touch with the financial and manufacturing interests of the United States, while the main office in Portland will keep itself informed as to local conditions in the West. Mr. Chambers, who has had a wide experience in reporting upon, designing and equipping large railway and power plants, is located in Portland, where he will give his personal attention to the business of the firm. Mr. Barstow, who is extensively engaged in engineering work in the East, is consulting engineer for the Portland General Electric Company, and is designing the electrical installation of the new 20,000-horse-power hydroelectric plant of the Oregon Water Power and Railway Company.

ELECTRICAL SECURITIES.

In the main the general upward tendency of security prices is being continued. This advance is peculiar, in that it has been secured despite the lack of public support. Starting from about the middle of May prices have been steadily advancing, and to-day stand very little short of the high level for the year. The street railway securities have been a dominant factor in current advances for some time. In addition to this, however, the general impression is extant that business is good and that the outlook is extremely satisfactory. With reports of additional dividends on many of the railroad and large industrial stocks, and the statement that earnings are continuing satisfactory, it is expected that a good line of buying will soon come about which will make for a prosperous fall and winter campaign.

ELECTRICAL SECURITIES FOR THE WEEK ENDING JULY 22.

New York:	*Closing.*
Brooklyn Rapid Transit	67½
Consolidated Gas	189½
General Electric	174
Interborough Rapid Transit	203
Kings County Electric	200
Manhattan Elevated	164½
Metropolitan Street Railway	125⅛
New York & New Jersey Telephone	172
Westinghouse Manufacturing Company	190

In order to provide for extensions and improvements the management of the Brooklyn Rapid Transit Company has sold an additional $2,500,000 of its 4 per cent convertible bonds at 86. The total amount of these bonds outstanding now amounts to $19,500,000.

Boston:	*Closing.*
American Telephone and Telegraph	139
Edison Electric Illuminating	244
Massachusetts Electric	64
New England Telephone	138
Western Telephone and Telegraph preferred	98

The gross and net earnings of the Massachusetts Electric Companies for the first seven months of the present fiscal year show an increase of $147,000 and $255,000, respectively, as compared with those for the corresponding period of 1904.

Western Telephone directors have declared the regular semi-annual dividend of 2½ per cent on the preferred stock, payable August 1 to stock of record July 21.

Philadelphia:	*Closing.*
Electric Company of America	11⅜
Electric Storage Battery common	80
Electric Storage Battery preferred	80
Philadelphia Electric	8⅞
Philadelphia Rapid Transit	27¾
United Gas Improvement	95¼

The total gross income of the Philadelphia Rapid Transit Company for the fiscal year was about $16,400,000, an increase of $470,000 over last year. The income of the railways proper was $16,200,000, and other income was $200,000. Gross earnings during June increased $95,000 over June of last year.

Chicago:	*Closing.*
Chicago Telephone	134
Chicago Edison Light	158
Metropolitan Elevated preferred	65
National Carbon common	63
National Carbon preferred	117
Union Traction common	7
Union Traction preferred	37

Chicago Edison directors have declared the regular quarterly dividend of 2 per cent, payable August 1.

LEGAL NOTE.

TROLLEY CONTACT SPRING CASE—An injunction order was filed in the United States Circuit Court, District of Massachusetts, on June 22, in the trolley contact spring case, involving Anderson patent No. 412,155, granting a preliminary injunction. The General Electric Company was the complainant, and William Hall & Company, defendants.

NEW INCORPORATIONS.

GALETON, PA.—Galeton & Hull Telephone Company. $5,000.

HARRISBURG, PA.—Chester County Light and Fuel Company. $5,000.

TOWANDA, PA.—Railroad Telegraph and Telephone Company. $10,000.

HAVELOCK, IOWA—Havelock Mutual Telephone Company. $28,000.

SLIPPERY ROCK, PA.—Slippery Rock Independent Telephone Company. $5,000.

HARRISBURG, PA.—Clearfield & Cambria Telephone Company, Berwindale. $5,000.

DES MOINES, IOWA—Creston Mutual Electric Light, Heat and Power Company. $50,000.

DES MOINES, IOWA—Interurban Railway Company. Increased from $500,000 to $1,000,000.

MADISON, WIS.—Walworth Telephone Exchange Company. Increased from $2,200 to $4,200.

DES MOINES, IOWA—New Sharon Electric Company. $75,000. Incorporators: W. A. and W. E. Bryan.

NEWELL, W. VA.—Newell Street Railway Company; $10,000. Newell Water and Light Company; $10,000.

BUFFALO, N. Y.—Buffalo Electric Company. $2,500. Directors: Robert Jones, William R. Jones and Salina E. Jones.

COLUMBUS, OHIO—The Home Lighting, Power and Heating Company, Springfield. Increased from $100,000 to $175,000.

OAKLAND, CAL.—The Central Electric Company. $30,000. Directors: W. W. Foote, Jr., E. M. Smith and Clarence M. Reed.

ALBANY, N. Y.—Volney Telephone Company. $500. Incorporators: E. B. Tice, James Vant, J. S. Moss, all of Volney, N. Y., and others.

DES MOINES, IOWA—Eitzen & New Albin Telephone Company, Winnebago, Houston County. $3,500. Incorporators: Henry Vonderohe and others.

ALBANY, N. Y.—Westport, Essex & Lewis Telephone Company. $3,000. Incorporators: Frank E. Smith, Melvin E. Lott and Aiken B. Blenn, all of Westport.

ALBANY, N. Y.—Wiltseville Telephone Company. $480. Incorporators: Otis A. Kipp, J. S. Stevenson and A. W. Wiltse, all of Hannibal, N. Y., and others.

ALBANY, N. Y.—The Commonwealth Telephone Company, Brooklyn. $200,000. Directors: E. M. Brooks, Daniel Bohre, Brooklyn; J. A. Crawford, Montclair, N. J.

JERSEY CITY, N. J.—The Clark Wireless Development Company, Jersey City. $20,000. Incorporators: Judson W. De Puy, William H. Bearinger and Charles Schlegel.

NASHVILLE, TENN.—Lick Creek Telephone Company, of Benton County. $500. Incorporators: I. N. Hull, T. C. Clymer, B. F. Stockdale, Thomas Dillon and W. A. Beaton.

DENVER, COL.—San Juan Light and Water Company. $100,000. Incorporators: Clement L. Herbert, Henry G. Berri, Arthur W. Stillman, Arthur L. Fisher, Parvin N. Pattison, Durango.

COLUMBUS, OHIO—The Commercial Transit Company, of Springfield. $50,000. Incorporators: Frank P. Torrence, T. J. McCormick, J. S. Harshman, E. B. Gunn and E. B. Phelps.

INDIANAPOLIS, IND.—Muncie & Portland Traction Company. $1,000,000. Directors: Morris L. Hageman, Lewis A. Clark, Webster S. Richey, A. E. Smith and John L. McPherson.

ALBANY, N. Y.—The Paul Smith's Electric Light and Power Company. $100,000. Incorporators: Paul Smith, Sr., Philip Smith, Paul Smith, Jr., and Arthur B. Banker, all of Paul Smith's, N. Y.; John M. Cantwell, Malone, N. Y.

SOUTH McALESTER, I. T.—The Choctaw Railway and Light Company. $500,000, of which $175,000 has been subscribed. Directors: A. E. Pierce, Jr., president; M. E. Williams, vice-president; R. L. Scheig, secretary and treasurer; A. U. Thomas, M. M. Lindly, Edward W. McAlester, W. B. McNaughton.

GUTHRIE, OKLA.—Gas, Acetylene and Electric Light Company, Detroit, Mich., and St. Thomas, Canada. $2,000. Incorporators: George Morton, John Campbell, Henry Lindop, William Cameron and Tyrell Dancombe, all of St. Thomas.

LEESBURG, VA.—Washington & Virginia Transit Company. To construct an electric railway from Washington, D. C., through Fairfax, Loudoun and Fauquier counties by way of Aldie and Middleburg. $400,000. President, M. E. Church, of Falls Church.

AUBURN, N. Y.—Weedsport Telephone Company. To operate telephone lines in Weedsport and other towns and villages in Cayuga and Onandaga counties. $20,000. Directors: Charles S. Caywood, N. E. Durston, George R. Nash, Wilson E. Palmer, L. R. Hopkins, of Weedsport; C. E. Tuxill and Cordello Herrick, of Auburn.

GUTHRIE, OKLA.—Standard Power and Construction Company, of Oklahoma City and Weleetka. Incorporated for the purpose of cutting a canal from the South Canadian to Weleetka, in order to get water power for the use in electrical plants. $50,000. Stockholders: B. O. Sims, C. H. Canewan, Luke Moore, of Weleetka; Charles De Watteville, of Oklahoma City; M. D. Owen, of Chandler, and W. A. Pollock, of Oklahoma City.

SAN FRANCISCO, CAL.—California Northeastern Railway Company. To construct a road from the Southern Pacific lines at Weed station, Siskiyou County, through that county to Klamath Falls, Klamath County, Oregon, with branches to Rhett lake and to the Lake in the Woods, the main line to be 110 miles and the branch seventy miles in length. $5,400,000. Directors: A. H. Naftzger, G. X. Wendling, H. Nathan, C. M. Cross and G. E. Bettinger.

NEW MANUFACTURING COMPANIES.

TRENTON, N. J.—The Norton Electrical Manufacturing Company has been incorporated by Abner Smith, Frederick G. Norton and David R. Hart. The capital is $100,000.

MADISON, WIS.—The Alpha Electrical Works has been incorporated with a capital stock of $5,000. The incorporators are Schiller N. Weller, Charles H. Hill and Archibald McKay.

LITTLE ROCK, ARK.—The Fort Smith Electrical Supply Company has been incorporated with $25,000 capital stock. The officers are: R. G. Hunt, president; W. R. Abbott, vice-president; George Engel, secretary and treasurer.

AUGUSTA, ME.—The Palmer Electrical Company has been organized to do a general electrical business, with $500,000 capital stock. The officers are: president, Charles D. Shaw, of Greenville; treasurer, R. M. Palmer, of Cambridge, Mass.

TRENTON, N. J.—The Sea Coast Electric and Manufacturing Company, of Lanoka, has been incorporated with a capital of $50,000, to manufacture electric arc lamps. The incorporators are Orian F. Lane, Daniel S. Holmes and George M. Lane.

CHICAGO, ILL.—The Chicago Insulated Wire and Manufacturing Company has been incorporated by T. C. Turlay, William M. Smith and Thomas B. Lantry. The company has a capital of $100,000, and will manufacture electrical supplies.

NEW YORK, N. Y.—The Amalgamated Gas Fixture Company has been incorporated to manufacture oil, gas and electric fixtures. The capital stock is $45,000, and the incorporators are Ringgold R. Aiken, Rockaway Beach; Bernard Sobel, New York; Jacob Donaldson, Elizabeth, N. J.

NORFOLK, VA.—A charter has been issued to the Franklin Lightning Rod Company to manufacture and sell lightning rods. The capital stock is from $5,000 to $10,000. The officers are: G. Y. Old, president, of Norfolk County; R. S. Marshall, secretary and treasurer, of Portsmouth.

TOLEDO, OHIO—The Toledo Storage Battery Company, with a capital of $50,000, has been incorporated by Fordyce Belford, Sarah Owens, George C. Bryce, E. J. Marshall and E. A. Byers. Half the stock is seven per cent preferred. This is a reorganization of the Toledo Storage Battery and Electric Company.

ELECTRIC LIGHTING.

GRAND HAVEN, MICH.—Contracts have been let for increasing the power of the electric light plant.

PHILADELPHIA, PA.—A new electric light plant will be established by local capitalists at Spring City.

OXNARD, CAL.—The plant of the Oxnard Light and Power Company has been completed and placed in operation.

BAY CITY, MICH.—The Thorne Electric Company has closed a contract with Tawas City to install a complete municipal electric light plant.

MANCELONA, MICH.—The building and fixtures of the electric light plant at this place were burned July 8. Loss, $5,000; insurance, $2,000.

SALT LAKE CITY, UTAH—An electric plant will be installed in Ephraim. The plant will cost about $17,000. Work is already well under way.

HUDSON, N. Y.—The electric light plant at Chatham has been sold to the Lindenwald Light, Heat and Power Company, an organization of local capitalists incorporated last spring.

VICTORIA, B. C.—A by-law will be submitted to the ratepayers providing for the authorization of a loan of $11,000 for the purpose of improving the electric light plant of Victoria.

YOUNGSTOWN, OHIO—The board of public service has awarded the contract for an electric lighting plant for the waterworks pumping station and the filteration plant to the Electric Supply and Construction Company at its bid of $4,133.15.

MARION, IND.—Sheriff Mills has received an order to sell the plant of the Fairmount electric light plant to the highest bidder, the sale to take place at public auction, August 2. The sale is to satisfy a mortgage for $22,000 held by Gilbert LaRue and Dr. J. W. Patterson. The mortgage was given by Francis Ingler.

SPRINGFIELD, ILL.—Minority and majority reports have been submitted by the Springfield council. The majority report, which also bears the approval of Mayor Devereux, declares for municipal ownership of the lighting plant which provides Springfield with street and other lights. The minority reports recommend advertising for bids for the light plant for a term not to exceed seven years and not less than two years, bids to be submitted by July 31, 1905.

TOPEKA, KAN.—The Edison Electric Illuminating Company has made important concessions to the business men's committee with regard to rates. The maximum of twelve cents has been eliminated and a sliding scale of from ten cents to six cents substituted. This has to do with the incandescent and decorative lighting used by the merchants and also for small power users on motors. This makes an average rate of eight cents. In residence lighting the rate specified is twelve cents. This is a reduction from the rate of twenty cents.

PORTSMOUTH, N. H.—The reorganization committee of the New Hampshire Traction Company, which operates the Rockingham Light and Power Company plant in Portsmouth, has concluded a bargain with the trustees of the Frank Jones estate for the purchase of the Frank Jones lighting plant, which has furnished light for many business places. The Jones lighting plant will be done away with and power furnished entirely from the Rockingham plant. The new purchaser will take possession about August 15. The purchase price is not made public.

NEW YORK, N. Y.—The Stock Exchange has listed $2,000,000 of the first mortgage collateral trust five per cent coupon bonds, due 1948, of the New York Gas and Electric Light, Heat and Power Company (the New York Edison Company, successor), to be substituted for $2,000,000 of negotiable bonds, now making $15,000,000 of said bonds listed. The New York Edison Company reports its income, including January 1 to May 31, as follows: gross earnings (all sources), $5,035,395; expenses, including insurance, taxes and contingency and renewal charges, $2,566,100; net earnings, $2,469,295; fixed charges, including interest bonds and floating debt, $826,831; surplus for the period, $1,642,463.

ELECTRIC RAILWAYS.

KANSAS CITY, MO.—The construction of the Kansas City, Olathe, Lawrence & Topeka Electric Railway has been begun at Olathe.

LA SALLE, ILL.—The Milwaukee Electric Railway and Light Company reports $133,309 net for May, an increase of $825, and for five months net $614,292, increase $19,982.

MARSHFIELD, WIS.—The Wausau city council has granted a street railway franchise to the Wisconsin River Power and Traction Company. A line will be built if sufficient capital can be interested.

MILWAUKEE, WIS.—James H. Elmore, of Green Bay, has deeded to the Milwaukee Light, Heat and Traction Company the right of way to parts of the old Beloit roadbed from Muskego Center to East Troy. It will now be used, under foreclosure proceedings, for a branch of the Milwaukee electric railway system.

LAMBERTVILLE, N. J.—At a special meeting of common council an ordinance granting the Trenton, New Hope & Lambertville Traction Company the right to lay and maintain tracks on certain streets of the city was passed on first reading. The company intends to run a short distance from the river bridge at present.

PITTSTON, PA.—Clairton is soon to be connected with Pittsburg by trolley. A new line is to be constructed from a point where the Pittsburg Railways Company's tracks pass through Dravosburg, and along the road sometimes called State street, but officially known as the West Elizabeth and Dravosburg township road, to Clairton.

REDKEY, IND.—Horace Stillwell, representing the Portland & Muncie traction line, has been granted a franchise over the city streets for the proposed road. The route through town will probably be along the main street, which will necessitate the removal of three frame business blocks. A completed line is promised in one year.

INDIANAPOLIS, IND.—The Shelbyville division of the Indianapolis & Cincinnati Traction Company will probably be extended to Greensburg within a few months, as a franchise has been granted at Greensburg. A franchise for the extension of the line through Shelbyville toward Greensburg will be requested at once by Charles L. Henry, president of the organization.

PHILADELPHIA, PA.—The work on the Philadelphia & Western, the new third-rail electric railway which is to parallel the Pennsylvania at least as far as Wayne, is progressing rapidly, some six hundred men being now engaged in its construction. The eastern terminus is to be at Sixty-third and Market streets, but the location of the western one has not been definitely determined upon as yet.

ROCKVILLE, CT.—The city council has extended until January 1, 1907, the life of the local franchise of the Rockville, Broad Brook & East Windsor Street Railway Company. Arrangements for financing the building of the road have been perfected, and the plans for building have practically been completed. Operations will begin at an early date. The company is backed by the Hartford & Springfield Street Railway Company, with whose tracks it will connect at Warehouse Point in the town of East Windsor.

NORFOLK, VA.—The Norfolk, Portsmouth & Newport News Company, the corporation controlling the Norfolk Railway and Light Company, the Berkley Street Railway Company, the Norfolk, Portsmouth & Newport News Railway and the Old Dominion Railway Company, of Portsmouth, at a meeting of its directors, held in Norfolk, decided to at once extend its line from Rodman Heights, now the suburban terminus of the Norfolk, Portsmouth & Newport News Company, to Churchland, in Norfolk County, a distance of five miles.

NEW CANAAN, CT.—The legislature has passed a bill, incorporating the New Canaan Street Railway Company. The corporation has a maximum capital stock of $500,000, and it is authorized to construct and operate a street railway in New Canaan and Norwalk in Connecticut, and in Pound Ridge and Lewisboro in New York. The incorporators are William Wardell, John E. Bliss, Charles B. Keeler, Frederick A. Palmer, Junius Benedict, C. N. Scoville, J. F. Silliman and T. Roberts, of New Canaan, and Lester Hyatt, Frank H. Merrill, Reed G. Haviland and W. F. Acton, of Norwalk.

INDUSTRIAL ITEMS.

THE L. E. KNOTT APPARATUS COMPANY, 15-17 Harcourt street, Boston, Mass., has issued a new catalogue descriptive of precision instruments. This will be sent upon request.

THE PEERLESS ELECTRIC COMPANY, Warren, Ohio, in No. 6, vol. ii, of "The Pigeon-Hole," calls attention to Peerless motors for special drives, and the type "O. D." oscillating fan.

THE OTTO GAS ENGINE WORKS, Philadelphia, Pa., has published an attractive booklet entitled "Some Reasons Why." This booklet illustrates and describes the Otto twenty-five-horse-power gas engine.

THE CLIFTON MANUFACTURING COMPANY, Boston, Mass., will be pleased to send data concerning Clifton iron-armored conduit and rubber goods. Mr. I. M. Post is the New York city representative at 308 West street.

THE WHEELER REFLECTOR COMPANY, 156 Pearl street, Boston, Mass., will be pleased to send its price list and descriptive catalogue of reflectors, shades, chandeliers, headlights, lanterns, street fixtures and electrical specialties.

THE DE LAVAL STEAM TURBINE COMPANY, Trenton, N. J., has issued bulletin No. 10, descriptive and illustrative of the works and product of the De Laval Steam Turbine Company, with a sketch of the inventor, Dr. Carl Gustaf Patrick de Laval.

THE GRAY TELEPHONE PAY STATION COMPANY, Hartford, Ct., has issued a catalogue of specifications covering equipment of toll stations with automatic collectors, together with such data as will be found useful in selecting and ordering this material.

THE AMERICAN ACID AND ALKALI COMPANY, Bradford, Pa., is in the market for the following second-hand electrical machinery: one 110-120-kilowatt, 200-220-volt, two-phase, alternating-current generator, direct-connected to either a steam or gas engine, preferably the latter.

THE STANLEY-G. I. ELECTRIC MANUFACTURING COMPANY, Pittsfield, Mass., has issued three new bulletins, No. 87, No. 145 and No. 245, describing, respectively, small-power, single-phase, alternating-current motors; type L direct-current motors, and type Z transformers. These bulletins will be sent upon request.

THE EASTERN CARBON WORKS, Jersey City, N. J., distributed an attractive series of blotters, calling attention to the "Atlantic" dry cell for intermittent work, and the "Eastern" high-grade dry batteries for all forms of open circuit work, at the recent International Electrical Exhibition held at Boston, Mass.

THE DIELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has published a new price list of "Dielectric" products. This includes "Dielectric" insulating varnishes and compounds, "Dielectric" asbestos-covered magnet wire, "Dielectric" linen tapes, "W. D." paint, flexible sheet insulating materials, and flux paste for soldering without corrosion.

FRANK B. COOK, 240-244 West Lake street, Chicago, Ill., has recently been granted a number of additional patents on self-soldering protective apparatus. Three such patents have been secured within a month, making a total of eleven self-soldering protector patents which have been secured during the last year. In addition to these eleven patents Mr. Cook states that advices have been received from the patent office to the effect that another self-soldering patent will be issued to him Tuesday, August 1.

THE LINK BELT ENGINEERING COMPANY, Philadelphia, Pa., has published a handsome catalogue descriptive of the "Renold" roller chain. The "Renold" silent chain transmits power in any quantity up to chain speeds of 1,600 feet per minute, its economical range being between 900 feet and 1,600 feet. The chain joints are of ample area to secure low unit pressures, and the roller bushing and pin are hardened to give durability without incurring disaster from brittleness. The steel is the best that the steel makers of Europe can produce.

G. M. GEST, the expert subway contractor, of New York and Cincinnati, has been awarded a contract for the construction of a complete underground conduit system at Washington, D. C., for the Western Union Telegraph Company. This conduit system will be constructed of a specially made steel pipe instead of clay and will connect all of the Western Union Telegraph Company's offices as well as the department buildings in and around Washington. Work to begin by the first of August, and several hundred men will be employed on same.

THE AMERICAN ELECTRICAL HEATER COMPANY, Detroit, Mich., has opened an eastern department at 35 Dey street, New York city. Mr. B. H. Scranton, president and general manager, is in charge. This branch was opened to take care of the eastern trade and the company contemplates carrying in stock a full line of its staple devices. This will include laundry-irons, disc-heaters, tea-kettles, chafing-dishes, water-heaters, warming-pads, soldering-irons, pressing-irons, boilers, glue-pots, foot-warmers, curling-iron heaters, and flexible cord.

THE INTERNATIONAL NICKEL COMPANY, 43 Exchange Place, New York city, is distributing a booklet containing a list of the purposes for which nickel steels have been successfully used in the United States, France, Germany and England. The properties of nickel steel are influenced not only by the proportion of nickel present, but also by the amount of carbon and manganese contained in the steel, and furthermore by whether or not the steel contains some other special element besides the nickel, such as chromium, tungsten, etc.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., is distributing a number of bulletins designated as Nos. 1062, 1063, 1064, 1065 and 1066, describing, respectively, type W induction integrating wattmeters; type W prepayment wattmeters; standard alternating-current switchboard panels for single-phase circuits; high-torque type K single-phase wattmeters; type K prepayment wattmeters. In addition to these bulletins there are two catalogues, one being an instruction book on type K multiphase induction integrating wattmeters, and the other a handsomely printed brochure entitled "Notes on Prepayment Wattmeters."

J. H. BUNNELL & COMPANY, INCORPORATED, 20 Park Place, New York city, have issued the twenty-fifth edition of their general catalogue. This catalogue contains large additions of important matter showing illustrations and describing many new improvements, mostly the company's own, in telegraphic and other electrical apparatus, together with a detailed and extensive line of supplies and tools. This catalogue is very comprehensive, and apparently covers every form of electrical apparatus or contrivance. The book is carefully indexed and furnished with a telegraphic code for orders and enquiries. It contains 368 pages, is well printed, and should be secured by every one interested in electrical apparatus.

THE A. C. & M. L. FELKIN COMPANY, 4 India square, Boston, Mass., is distributing an illustrated pamphlet showing a number of forms of "Imperial" electric signs. This company is the manufacturer of electric and all other styles of signs. In the electrical sign the letters are made from white opal glass glazed in lead. The shading of the letters is of colored cathedral glass, eliminating any painting. The letters are soldered to a zinc rustproof background. The inside reflectors are of galvanized iron. The signs are painted with two coats of white lead and finished in white enamel. The face of the sign is finished with carborundum or diamond smalts. The rope mouldings and carved ornamentations are finished in gold-leaf.

THE H. W. JOHNS-MANVILLE COMPANY, 100 William street, New York city, has issued a new electrical catalogue, No. 14. This catalogue is handsomely bound in cloth, and is replete with interesting data and specifications of electrical auxiliary apparatus. This catalogue supersedes all previous issues. All weights given are approximate, and numbers and code words are to be used in ordering. The book is carefully indexed under several sections. Section i describes trolley line material; section ii, trolley ears, clips, splicing sleeves, etc.; section iii, strain insulators and turn buckles; section iv, pole bracket arms and section insulators; section v, pole-line and third-rail insulators; section vi, miscellaneous materials; section vii, tools; section viii, "Noark" enclosed fuses and devices; section ix, moulded mica sockets; section x, electric heaters and electrotherms; section xi, "Vulcabeston" and moulded material; section xii, general information and data; section xiii, telegraph code; section xiv, indexes.